ENTERIC FEVER IN INDIA

BY

J. BUTLER HAMILTON, *M. D.*,

BRIGADE SURGEON, MEDICAL STAFF;

FELLOW OF THE ROYAL ACADEMY OF MEDICINE IN IRELAND;

FORMERLY STATISTICAL OFFICER TO THE SURGEON-GENERAL, HER MAJESTY'S FORCES;

IN MEDICAL CHARGE OF THE STATION HOSPITAL, LUCKNOW.

ALLAHABAD:
PRINTED AT THE PIONEER PRESS.

1888.

133 C 11

IMPERIAL ... R Y.

THE FOLLOWING PAGES ARE DEDICATED

TO THE MEMORY OF

JAMES BRYDEN, *M. D.*,
SURGEON-MAJOR, *I. M. S.*,
LATE STATISTICAL OFFICER WITH THE GOVERNMENT OF INDIA,

IN AFFECTIONATE MEMORY

OF HIS MANY ENDEARING QUALITIES,

AND THE VALUABLE INFORMATION I GAINED

FROM BEING ASSOCIATED WITH HIM IN

YEARS GONE BY.

CONTENTS.

Page

CHAPTER I.—Definition and Diagnosis 1

" II.—Predisposing Causes 14

" III.—Pythogenetic Origin of Enteric Fever .. 26

" IV.—The Symptoms of Enteric Fever as observed in India 36

" V.—The Stages and Duration 49

" VI.—Prophylactic Measures 56

" VII.—The Management of Enteric Ward .. 70

" VIII.—Nursing of Enteric Fever 78

" IX.—Dieting of Enteric Cases 84

" X.—Curative Treatment 91

" XI.—General Conclusions 107

PREFATORY REMARKS.

IN placing the following pages before my brother officers of both services, I feel, now that the task is done, the theme is worthy of a better hand. The work of a Medical Officer in charge of a large Station Hospital leaves but little leisure for literary work, and were it not that I felt it my duty to utilise the great experience I have had in this disease, in Dublin, the Soudan, and Lucknow, during the past six years, I would never have attempted it. The more I see of enteric fever the more I am satisfied that much might be done to mitigate its severity in India.

Take this fact. During the past three years there have been nearly 300 cases of this disease in Lucknow with some 40 deaths, while each of the survivors may be said to have been inefficient for, from four to six months.

During the same period there have been about 25 cases of cholera and some 10 deaths. Let a single case of cholera appear, and precautions of every-kind are at once taken, with, practically, no limit to expense. Could the same precautions, expense, and trouble be devoted to the detection and eradication of enteric fever, how much inefficiency and how many lives might not be saved? In the matter of the milk-supply alone, an enormous improvement might easily be effected at comparatively little trouble and expense.

We have come to regard enteric fever as a "thing of course," one that must be expected and looked for, the result being an apathy, or feeling of helplessness, seems to have come over all concerned. Our medical organisation under the new system is much to blame for this. In former times there would have been at least four Surgeons-Major, one with each corps, all mounted officers, in Lucknow, with a proportionate number of senior Surgeons to assist and look after the lines and sanitation of the barracks. These experienced officers have been replaced by junior Surgeons, many of them without previous Indian experience, and though, theoretically, they are equally as well instructed as the men they have replaced, no one can doubt that, practically, they are not equally efficient. With the advent of the young soldiers in increasing proportion, we have had our older Medical Officers replaced by younger ones, exactly the reverse of what one would have expected, as, with an increase in the number of young soldiers, we must expect an increase of acute disease, and should therefore have a better organisation to meet it. On top of this there are the constant changes of Medical Officers and Medical Subordinates, unavoidable no doubt under the present system, but none the less a source of inefficiency.

Our strength is sufficient for peace, but no provision is made for war, and with three little wars going on at once—Burma (practically still field service), Sikkim, and the Hazara Expedition—Medical Officers and Subordinates have been drafted off in large numbers from every station.

India has no reserve. The establishment is essentially a peace establishment, and when war breaks out the station hospitals have to provide for the forces in the field, while the sick in cantonments suffer, as a matter of result.

What we require for India is, *first*, a larger proportion of senior officers; *second*, an increase in the Subordinate

Medical Department; *third*, every Medical Officer should be mounted; *fourth*, on the breaking out of war, the establishment of Medical Officers should, at once, be strengthened from home. These remarks may seem foreign to the question of enteric fever, and perhaps they are; but till our medical organisation is strengthened and improved, and our nursing arrangements put on a proper footing, it will be impossible to grapple with this disease in a thorough and efficient manner.

J. B. HAMILTON.

ENTERIC FEVER.

CHAPTER I.

DEFINITION AND DIAGNOSIS.

ENTERIC fever, as defined by Murchison, is "an endemic disease, generated and propagated by certain forms of decomposing organic matter."

Accepting this as the definition of the disease as it is seen in temperate climates, the first question that presents itself is, whether the same definition is applicable to the disease as seen in India and other places in the tropics.

It is a common belief, not only among the general community but even shared by many medical men, that enteric fever is a comparatively modern disease in India, and that twenty or thirty years ago it was unknown in this country. Indeed, only a few years ago, a distinguished administrative officer in Southern India endeavoured to prove that no such disease existed, and, as a matter of fact, all but abolished enteric fever from the returns of the Presidency over which he held medical sway.

Our knowledge of enteric fever in India may be admitted to be of comparatively recent date. Indeed, twenty-five years ago the disease was hardly recognised in this country. There is, however, no doubt that enteric fever has existed in India, probably as far back as the advent of European troops, possibly among the native population (unrecognised) for ages. As Dr. Bryden has pointed out, there is abundant evidence to prove that enteric fever has existed in the past to as great an extent, relatively to the number of young soldiers, as at present. One incontrovertible fact proves this, *viz.*, that whereas the deaths from enteric fever have largely increased of late years, the deaths from all other forms of fever have much diminished. Now, deaths from uncomplicated malarial fevers are very rare, especially since the introduction of quinine, so that we may take it as certain that a large proportion of the fatal cases formerly attributed to malarial fevers, especially remittent fever, were really due to enteric fever. To this must be added the evidence of numerous *post mortem* examinations on record, where the patient was declared to have died of remittent, intermittent, or simple continued fever, and on going over a number of old annual reports in the Simla Office, in several I found the clearest evidence of fatal cases, entered as malarial or simple continued fever, having been unrecognised enteric fever. At the present day there is frequently a disposition to diagnose mild or doubtful cases of enteric fever as malarial or simple continued fever. Even in the same division different medical officers constantly show widely different statistics. In one station there will be seen a considerable prevalence of enteric, with a comparatively small number of deaths, while in another, under much the same conditions as to climate, youth and recent arrival of men, very few cases of enteric fever will appear in the returns, but at the same time a high death-rate from this disease, with many cases of simple continued or remittent fever, the truth probably being that a great proportion of the latter classes were mild or aborted cases of enteric fever not diagnosed.

The Report of the Sanitary Commissioner with the Government of India for the year 1886 shows clearly "that the disease returned as enteric fever is no new disease to India, that the only change has been a change of diagnosis;" in fact, enteric fever was, relatively to the number of young soldiers, as prevalent in former years as it is now.

The history of enteric fever in India is therefore difficult to trace, and Murchison (edition 1884) alludes to it in the following terms:—"There can be no doubt that enteric fever is met with in the tropics, where it has probably been often mistaken for remittent fever. In India it is far from uncommon." According to Dr. J. L. Bryden, "enteric fever is the one disease of India by which the young soldier dies," a truism which even at the present time is not sufficiently recognised by many medical officers. Indeed, it is extraordinary in how many instances a diagnosis of enteric fever is avoided, and, in ill-defined cases, one of malarial or simple continued fever is substituted.

The remarks of the Sanitary Commissioner, in the report above alluded to, page 25, set forth the different diagnostic views held by various medical officers, and to illustrate the diversity of opinions, it will be well to quote his remarks:—

I.—*With regard to frequency and causation*—

(*a*).—Enteric fever is the principal fever of India, with ague and simple continued, and some of the cases returned as simple continued or ague are in reality mild cases of enteric.

(*b*).—There are separate diseases called enteric fever, remittent fever, simple continued fever and ague, the differential diagnosis of which is, or will be, possible through patience, perseverance, and increasing knowledge.

(*c*).—There are cases which can easily be recognised, respectively, as enteric, remittent, simple and ague; but the difficulty of diagnosis, when it exists, corresponds to the reality that these affections shade off into each other, being due to one *causa causaus* influenced by different circumstances.

(*d*).—There is little or no enteric fever in India, meaning thereby the disease so called in Europe, but fever with catarrhal follicular inflammation and ulceration of the intestines is common, *an* enteric fever, but not "enteric fever."

2.—*With regard to nature and causation*—

(*a*).—The disease and its causation are the same as in England, in spite of irregularities in course and appearances, and of difficulty in catching the cause *in flagrante delicto.*

(*b*).—The disease is enteric fever, but distorted by the intercurrence of malaria.

(*c*).—The disease is a hybrid of enteric and malarial fevers.

(*d*).—The disease is purely malarial.

3.—*With regard to causation*—

(*a*).—The disease is due to climatic or telluric influences acting on young and unacclimatised men.

(*b*).—The disease is due to local insanitary conditions acting on young and unacclimatised men.

Reading the above, an analysis of the opinions of a large number of medical officers in charge of European troops, one may fairly exclaim, *quot homines, tot sententiæ!* Notwithstanding this extraordinary divergence of opinion, I consider that, in the vast majority of cases, the diagnosis is comparatively simple between enteric and malarial fevers.

I particularly specify these two fevers as the only ones in which mistakes should be possible, as in the eruptive fevers the symptoms are unmistakeable; and as regards "simple continued fever," I hold no such disease exists—a contention I hope to be able to satisfactorily prove later on.

Th emain question then is, can or ought malarial fevers to be mistaken for enteric fever, or *vice versâ?*

Surely the diagnosis ought, in the vast majority of cases, to be simple in the extreme. In the first place, the "youth" and "recent arrival" of the patient should invite suspicion. Newly-arrived drafts of young men land during the cold season, or the commencement of the hot, and if any of this class be attacked by a fever, suspicion should at once point to its being enteric. Young men, during the first few months of their service in India at all events, are not liable to malarial fever, unless they have been specially exposed to its influence, *e.g*, have marched through the "terai" or some other well-known malarious tract. Ague and remittent fever are more diseases of the older soldier, and he will, on being attacked, at once recognise the fact himself, and describe the symptoms accurately. Again, in malarial fevers, the course of the disease is easily recognised, and, as a rule, the temperature chart tells its own tale. Quinine cures it, and convalescence is generally rapid.

Very different is it, however, in the case of a young soldier attacked by enteric fever. First, we have his "youth" and his "recent arrival" in the country to attract our attention. Next, we generally have some evidence of the absence of previous attacks of enteric fever. Again, the fact that the season of the year—assuming the attack comes on in the end of the cold weather, spring or dry hot weather—is unusual for a *first* attack of malarial fever. Of course, later in the year this diagnostic aid is not available. Then there is the temperature chart to guide one, and the general appearance of the patient, with the course the disease runs—and in addition, the usual diagnostic signs and symptoms of enteric fever. No doubt in many cases these signs and symptoms are, more or less, obscure, but in the vast majority they are sufficiently clear to indicate the true nature of the attack, if carefully weighed and considered. The subsequent debility, if all else fail, is, to my mind, an almost indisputable evidence of the enteric nature of the disease in a young, newly-arrived soldier, and in several instances I have been unable to convince my colleagues of the presence of enteric, in a mild form, till the resulting anæmia and debility afforded the last necessary indication of the nature of the attack.

I consider, therefore, that, with proper care in diagnosis, there ought to be little or no difficulty experienced in differentiating between attacks of enteric and malarial fevers. No doubt cases will occur, and shall be alluded to later on, in which the two diseases seem to resemble each other; but this is generally in the early portion of the attack and before the symptoms are fully developed. Again, towards the termination of an attack of enteric fever, the disease appears often to take on a remittent or intermittent type, but there is no difficulty in recognising this form towards the end of an attack of enteric, modified, perhaps, by malarial complications.

The next point to consider is the "so called" disease simple continued fever, and it is more than doubtful, in my opinion, whether any such disease really exists. Murchison, while adopting the term and describing the disease, discounts the nomenclature very distinctly. He says at page 18:—"In simple continued fever, which is independent of a specific poison, the nervous system seems to be affected primarily. The best illustration is to be found in the fever that occasionally results from sheer nervous exhaustion consequent on mental or bodily fatigue." Surely some better term than simple continued fever might be found for this condition of the system? Recognising this, the term "heat exhaustion" was introduced during the Soudan Campaign of 1885, to specify the very conditions to which Murchison gives the name of simple continued fever: the expression was significant of the causes that led to the disease, even though a happier phrase might have been chosen.

Again, at page 419, Murchison says:—"Medical men often decline to call a fever 'enteric,' in which, as often happens, there are no enteric symptoms, and hence the intestinal lesion is apt to be overlooked till it unexpectedly becomes a source of danger. This mainly accounts for the circumstance that in the returns of the Registrar-General, deaths are weekly ascribed to *simple continued fever*—a disease which in twenty-five years has not once been fatal in the London Fever Hospital." How applicable these remarks are to India! I have known cases of fever lasting over a month, even two months, and terminating fatally, returned as simple continued fever; and further, the medical officer insisted on the correctness of his diagnosis, even though the records of the *post mortem* examination clearly revealed the disease had been enteric fever. At page 549, Murchison again writes:—"Most of the febrile attacks known in this country (England) as "simple continued fever" or "febricula," are abortive attacks of enteric fever, terminating between the tenth and twentieth days." In speaking of enteric fever at page 593, Murchison again remarks, alluding to slight and badly-defined cases:—"In any of these ways the patient may pass through the entire attack and make a good recovery, and then the illness is spoken of as *simple continued fever*." In the face of such evidence as this, surely the term "simple continued fever" would have been better omitted from the nomenclature, and that of "febricula" retained The latter expresses exactly what is the case—a "little fever," due probably to some temporary exciting cause. If there is such a disease as "simple continued fever," how is it that it has not, up to the present, been more accurately differentiated, its symptoms detailed, and a typical temperature chart published? It is far too much the custom to put down all doubtful febrile attacks to the credit of simple continued fever; and if records of such cases were accurately kept, there are few indeed that could not be more positively diagnosed and returned under their proper heading.

In the Lucknow Station Hospital, where more cases of enteric fever have been treated than in any other hospital in India during the years 1886-87, the term "simple continued fever" has ceased to be used. Most careful records are kept of every suspicious case, and during the year 1887, but one case of simple continued fever appears on the register; that one was diagnosed, during my absence on leave, by a medical officer in temporary charge of the station hospital. No difficulty has been found in separating enteric from malarious fever, and all the medical officers in charge of cases find the true diagnosis of these diseases an easy matter when carefully worked out.

I have now before me temperature charts of cases of enteric fever that, no doubt, would by many, judging from the charts alone, be set down as cases of simple continued fever, so mild were the attacks, and for so few days did the fever run, yet in nearly all these cases the other symptoms were so well marked as to make the diagnosis practically certain. In all there was headache, or giddiness; in many diarrhœa; in nearly every one iliac gurgling was detected; and in the great majority, either rose spots or the "*taches bleuâtres.*"

In addition to this, in nearly every case the patient admitted having been ill for several days before reporting sick, and in every instance there was subsequent debility and anæmia of such a nature as to make it absolutely certain the man had had a mild attack of enteric. Debility, it is well known, to any marked extent at all events, seldom follows slight attacks of malarial fever, or of ardent fever from exposure, surfeit, &c. A still more remarkable proof, if one be needed, is the fact that in several instances, in which the disease at first ran a very mild course, and the patient was apparently convalescent for several days, relapses followed. In many of these instances the fever was most severe, lasting for many days, and in some instances proving fatal. The temperature chart of several of these cases, if taken as an indication of the presence of enteric fever up to the date of the first apparent convalescence, would have led many observers to declare them not to be enteric; but the chart, viewed as a whole, went to prove either that the attack was, in the first place, a mild one, with a tendency to abort, and subsequently became aggravated by either improper diet or imprudent exercise, or that the first attack was really one of simple continued fever (if such a disease exists), and that the attack of enteric was secondarily developed. Common sense will, I think, take the first view of the case, though undoubtedly the second is quite admissible as a theory. Had this taken place in one or two instances only, there might be some doubts on the subject, but when numerous cases followed in the same track, the former view is, I submit, the more reasonable.

My contention, therefore, is, that the safest course to adopt, in dealing with cases of fever of an uncertain character, especially in young and recently-arrived European soldiers, is to regard them all as possible cases of enteric, to admit them as "not yet diagnosed," to keep them under close observation in bed, to have their temperatures carefully taken morning and evening from the day of admission, to avoid the use of purgatives, to diet them on milk, and, in fact, observe an expectant attitude till the true nature of the disease is manifest.

The neglect of these precautions may lead to disastrous results, not only to the patient, but to his comrades. Suppose, for instance, a lad suffering from enteric fever, in the early stage, reports sick complaining of constipation and headache, and is ordered a dose of compound jalap, and marked "medicine, duty;" he returns to his barrack, and is freely moved by the medicine. Such treatment not only intensifies the disease, but possibly, through the latrine, infects his comrades. Even if not actually admitted to hospital, it is advisable, during the prevalence of enteric fever, to "detain for the day" all young soldiers reporting sick with suspicious symptoms. If the thermometer shows no rise of temperature at the evening visit, the man is probably only suffering from some mild bilious or other digestive attack, but even then it is safer either to detain him, or to require him to attend next morning for further examination.

It is also highly advisable that regimental officers should be instructed not to discourage young soldiers reporting sick, as, if men report sick without a cause, they can be punished on the report of the medical officer; on the other hand, if men sickening with enteric fever abstain from reporting themselves, what might have been a mild attack, may, in consequence of eating improper food or taking violent exercise at a parade or in the gymnasium, be intensified and aggravated to the great risk of the sufferer.

This has actually happened in my own experience quite lately, and two men, both of whom passed through severe attacks of enteric fever, informed me, and I ascertained their statements were true, that the N. C. officers of their companies had threatened them with punishment if they came to hospital. My experience of the young soldier of the present day leads me to believe that malingering is very rare, and, if attempted, the use of the thermometer and a careful examination of the delinquent usually reveal the truth. In any case it is better that ten malingerers should escape their well deserved punishment, than that one really sick man should suffer.

If, then, the above system is followed, and all suspicious cases are kept under close observation till the nature of the disease is evident, and if all cases of fever, not the result of some recognised or specific disease, are looked on as enteric fever till they are proved to be something else, the minimum of mistakes will be made, and what mistakes are committed will be on the safe side, both for the patient and his comrades, in barracks and hospital.

I have already alluded to the misleading nomenclature "simple continued fever," and for my own part I would be glad to see the term erased from the returns altogether. Personally I do not believe in the existence of any such disease. The term "febricula," which existed in the last edition of the nomenclature, and which is still shown as a "variety" of simple continued fever, was an excellent one, and well expressed a numerous class of cases now called simple continued fever for want of a better designation. For instance, a soldier having taken a heavy dinner in the middle of the day, and having perhaps drunk a couple of pints of beer, lies down on his bed, goes to sleep, and wakes with an attack of indigestion. He is brought to hospital, and the thermometer reads 103·5°. After a dose of compound rhubarb and a couple of days in bed, his temperature falls to normal, and he is well. What better term then "febricula" could be used to express this attack? Or, a man goes out shooting and comes back, after exposure to the sun, with a splitting headache and a temperature of 104°. A purgative, and cold water to his head, set him all right, and in three days he is at his duty. Febricula excellently describes such a seizure as this. Now, as a rule, all such cases will be returned as simple continued fever, which they undoubtedly are not.

If medical officers would only for a moment consider how the suppression of cases of enteric fever tells against themselves, they would be more chary of making a wrong or timid diagnosis. For instance, if in any hospital the deaths to attacks of enteric fever show a high percentage, say 25 to 40 per cent of deaths, it would appear a confession, either that a large number of cases were not diagnosed correctly, more particularly if there are cases of simple continued fever or remittent fever in the returns, or that the cases were not efficiently treated. The deaths in civil hospitals in Europe average 17 per cent to attacks, and even granting the difficulties of treatment in this country, owing chiefly to the almost total absence of skilled nursing, and, in the hot season, especially to the aggravating effects of climate, a death-rate of much over 20 in 100 must be looked on with grave suspicion, so far as regards the correctness of the diagnosis.

From the 1st of January, 1886, to the 1st October, 1888, I have had 259 admissions in the Lucknow Station Hospital for enteric fever with 36 deaths, a percentage of 13·8 deaths to attacks. Of these deaths, several were due directly to heat, and had they been treated in a more moderate temperature, I have no doubt but that the mortality would have been even less. In these cases the diagnosis was only arrived at after several days of close observation. In all of them consultations were held, and no decision was arrived at so long as there was any reasonable doubt. In addition, I had the valuable assistance of independent observers, who visited the wards at my request, and coincided in the correctness of our opinions. I would therefore strongly urge on medical officers to be most careful in their consideration of the fevers of young soldiers, and to bear in mind the danger of suppressing a diagnosis of enteric fever, as it is far better in all doubtful cases to let the balance incline to the graver side.

CHAPTER II.

PREDISPOSING CAUSES.

MR. JAMES BRYDEN has clearly shown that the great factors of enteric fever among Europeans in India are "recent arrival" and "youth," the former being probably even a more marked one than the latter. The first two years of residence are, in my experience, the most fatal ones. In proof of this the last Sanitary Commissioner's report shows the percentage of liability in the first and second years of residence to be 64·12, while in the third and fourth years it drops to 24·59, and from the seventh to the tenth, it falls as low as 8·52. In the same report the percentage of liability of men under 25 is shown to be 63·05; from 25 to 29, 26·10; and from 30 to 34, but 8·65.

There can be no doubt whatever, then, that the disease is far more prevalent among young officers and soldiers lately landed in India than among the older and more matured residents. From this more than one deduction may be made. First, it will partly account for the fact that enteric fever has been only comparatively lately recognised as a distinct disease in India, because, in former years, the majority of the men were more mature even in the newly-landed regiments, the long service rules being then in force. Again, when regiments went home, old soldiers were induced by liberal bounties to serve on in India in other regiments in considerable numbers, consequently drafts were not numerous, nor were they composed of immature lads, as they now so frequently are; *e.g.*, I have had many young soldiers in hospital lately who, I am confident, were well under 19, and one boy, a "duty private," admitted to the General Officer Commanding, in my presence, that he was under 17.

The influence, therefore, of "youth and recent arrival" as factors of the disease were much wanting in former years, so that occasional cases of enteric were all the more likely to escape notice. I served myself in the old 16th Brigade R. A.—a former Bengal Artillery Brigade—for 10 years, and during that time very few young soldiers joined from home. Our losses from death, invaliding, and discharge, were generally made up by volunteers from brigades going to England, or from batteries being broken up. In this body of men, who were particularly, mature, large, and muscular, during the whole period I was in the brigade, I cannot recall a single case of enteric fever. Judging from the statistics of the past few years, it may be taken as an axiom that enteric fever will be a certain result of the advent of either fresh corps from home or of a large draft of recruits joining a regiment in this country. The season of 1886 certainly bears out this argument, as, in consequence of the increase to the army in India, all the corps in this garrison had large drafts sent out, among the men of which, chiefly, enteric fever prevailed. Admitting, however, to the fullest, the influence these factors have on the prevalence of enteric fever, we must look to other causes for the *materies morbi.* The mere fact of a man being under 25 years of age, and under two years in India, will not account satisfactorily for his suffering from enteric fever, a disease which the best authorities hitherto believe demands, for its development, infection from a specific source. No doubt "youth and recent arrival" are powerful predisposing causes, and, given a number of young men lately landed in India, we may expect to have more cases of enteric fever among them than in a maturer body more acclimatised, but for the actual seeds of the disease we must look further.

The diet of the soldier in the hot weather is far too stimulating, and when combined with a liberal amount of strong beer, another most active factor is unmasked. Taking the ration in India, with the "extra messing" provided in every corps, the amount of food will be about equal to "entire diet" in the hospital scale at home.

This, as shown by Parkes, is composed as follows:—

		Grains.
Nitrogen	...	... 270
Oxidizable	Carbon	.. 4,434
	Hydrogen	... 140
	Sulphur	... 31

	Potential energy in foot tons.
Albuminates	... 676
Fat ...	... 930
Carbohydrates	... 1,977
Total	... 3,583

When to this is added two or three pints of strong beer daily, it will be seen that the British soldier in India, during the hot weather, when he takes little or no exercise, is decidedly overfed. The potential energy represented by over 3,500 foot tons can be usefully expended during the cold season, when the soldier is being drilled daily, going through gymnastic courses, marching, parades, &c. But during the hot months, when parades and drills are few and short, and the men pass the greater portion of the twenty-four hours lying down under a punkah, such an amount of food would appear superfluous. In addition to this, the meat in the hot season has to be cooked immediately after it is killed, and is therefore very tough and indigestible, added to which the method of cooking in India does not render it easy of assimilation. This amount of food, without exercise to work it off, and in too many cases the addition of a liberal supply of malt liquor, combined with the heat of the climate, must keep men in a feverish condition, and probably infarcts the mesenteric glands, thus rendering them all the more liable to receive the infection of enteric fever, however it may be conveyed to them. I am quite aware of the difficulty there is in making alterations in the scale of rations for troops. Still the attempt is worthy of trial, and even if the actual scale is not altered, much might be done regimentally to improve the cooking of the present ration.

Heat, as a predisposing cause, seems to have a decided influence, and the increase in the number of admissions at Lucknow was well marked, specially in 1886, as the hot season advanced, till in the month of May it culminated in 50 cases being under treatment at one time. Heat may act in two ways: one, by causing a feverish condition of the body, which, combined with an over-stimulating diet, may induce infarction of the mesenteric glands; secondly, by making the enteric poison in the excreta of ambulatory cases more active, as a result of more rapid decomposition. It is even probable that the rapid decomposition of healthy excreta in neglected latrines may induce disease in men whose constitutions are peculiarly prepared for the reception of the poison by the presence of the factors before enumerated. Given a lad lately arrived in India, fed on an over-stimulating diet, consuming two or three pints of strong beer daily and exposed to a high temperature, it can be easily imagined how, under such circumstances, a very small spark indeed of the specific poison will suffice to develop enteric fever. I would then regard the following conditions, enumerated in order, *viz.*—I, recent arrival; II, youth; III, over-stimulating diet, and IV, heat, as the chief *predisposing* causes present and common to all young soldiers recently landed in India.

We must next look for the actual or possible direct causes of infection. In the first place, can the disease originate *per se*, *i.e.*, given a station perfectly free from enteric poison.

will enteric fever be likely to appear among a body of newly-arrived troops? In other words, can the disease be generated without the presence of the infective material being already in existence? To this question I have no hesitation in giving an answer in the affirmative. The history of enteric fever during the Suakim Expedition would seem to show that, under favorable circumstances, the disease can originate and become epidemic, just as I believe could typhus fever. While again other diseases, such as small-pox or scarlet fever, would seem to demand the presence of the specific poison before they could appear among healthy persons.

The instance of the Suakim Expedition will be further alluded to later on.

If we once admit the power of enteric fever to develop spontaneously, much of the difficulty of investigation that has hitherto surrounded outbreaks of the disease in India will be cleared away. I can myself see no reason to doubt this theory, which is, to say the least of it, useful to the extent that, if admitted to be true, our exertions in the cause of sanitation should become more vigorous than ever. The great principle *sanitas sanitatum, omnia sanitas*, must never be lost sight of, and yet, odd to say, there is probably hardly a country in the world where sanitation, outside our European Cantonments (and some of the large cities) is more thoroughly neglected. Let us, for an instant, consider the several conditions of sanitation under which the 250,000,000 inhabitants of India exist, which may be briefly summed up as being as bad as possible. The excreta of this vast population are daily deposited on the surface of the ground, and allowing 8 ounces per head per day, it is evident that 125,000,000 lbs. daily, or a total of 20,000,000 tons a year, are spread on the surface of the land. No doubt the area is a great one, but the dessication and diffusion by the wind of such an enormous amount of human excreta must be regarded as a great possible source of evil, fouling the water and food-supply of the entire country. From experience I can say that the environs of every village are practically an open cess-pit, and even in the immediate neighbourhood of our military cantonments, matters are little better. The native of India is, perhaps, the most extraordinary anomaly in nature. Bound down by caste prejudices in a manner inexplicable to Europeans, he will throw away his food if even the shadow of a stranger or lower caste native falls on his cooking place. Even in the matter of drinking, he is so particular that a Brahmin would die of thirst sooner than drink out of the vessel of a man inferior to him; yet this same Brahmin may be seen washing and drinking in a tank, the banks of which are covered with human excrement, washed by every shower into the water he does not hesitate to use for all domestic purposes.

Given these conditions, how far need we seek for the causes of disease? Hitherto enteric fever has been supposed not to have been a disease of the native population But latterly some of our most careful observers are putting forward widely different views Hereafter it may appear that not only is enteric fever not an uncommon disease among the natives of Hindustan, but is, on the contrary, very prevalent. Being probably, however, a disease of childhood, occurring among the children of a non-meat-eating population, it is not so easily recognised as it would be if it were a disease of youth or adult life, as it is in Europe. Thousands of native children die yearly in Indian villages of fever and diarrhœa, and how are we to differentiate between these cases and enteric fever? The truth possibly is, that most natives pass through a mild attack of enteric fever in childhood, and thus become protected as adults. This would certainly account for the rarity of the disease in the ranks of the native army and in the jails, in which places only are natives under close, skilled, medical supervision. Certainly these are sufficient grounds to found a theory on, and to make the matter worthy of full inquiry. Such an inquiry could easily be carried out in selected localities by means of native Assistant Surgeons, some of whom might be deputed to investigate cases of a suspicious nature in children, and collect a number of temperature charts and clinical notes for submission to a Committee of Inquiry. Something on the system of the "Collective Investigation Committee," so ably worked under the auspices of the British Medical Association, ought to be able to elicit the truth on this point. Admitting, then, for argument's sake, the possible existence of enteric fever as a disease of the native population—a fact, be it remembered, hitherto strenuously denied by nearly all writers on the subject—we have not far to seek for a source of infection of our young soldiers. Lads just landed in India, after being boxed up for several weeks on boardship and in troop trains, are mostly only too eager to visit the native bazars, partly for the love of sight-seeing and change, and partly no doubt for less reputable purposes. Thirst is pretty constant to most men in the hot season, and gratifying it with water, lemonade, or "pop," in the bazar is only natural. This at once may be, and probably is, a fruitful cause of infection. Any one who has visited the back-slums of our Sudder Bazars must be aware of the hidden insanitation that generally prevails, and when the surroundings are foul, what wonder is it if the food and drink are unclean also? Perhaps not unclean to the senses,

133C11

but our home experiences of outbreaks of enteric fever traced directly to contamination of milk or water, must show us how easily similar contamination may take place out here, and given enteric fever among the children in the bazar, all the factors of infection are present in a high degree

The milk-supply brought to barracks may also be a cause of infection in consequence of dilution with bad water, or through the filthy method of feeding adopted by the milkmen when forage is deficient. I have known the riding schools to be covered with horse litter from the stables in the day, and next morning it had disappeared, eaten by the very cows and buffaloes that supplied the hospital and barracks with milk. The first point an investigator of an outbreak at home directs his attention to, is milk, and undoubtedly in India it is frequently a source of disease. People fancy, perhaps, that because cows are milked in their presence, it is impossible milk can be impure. Never was there a greater error. Even if nothing but the actual milk, as taken from the cow, be consumed, there is much chance of its' being a source of infection, as cows are, in India, frequently filthy feeders. During the dry and hot weather, when grass is scanty and dear, the "gwallahs," as is well known, feed their cows on the filthiest of food. Horse litter, as alluded to above, is greedily devoured by their half-starved cattle, and even fouler garbage does not come amiss. Here, then, is at once another possible cause of infection, as it is now admitted that ill-fed cows, *e. g.*, on the grass of sewage farms, may, through their milk, propagate infectious disease. Milk, diluted with bad water, will account for any amount of enteric fever, and at first sight this would seem a sufficient reason for all the disease in this country. Last cold weather, 1887-88, during the Camp of Exercise at Lucknow, an outbreak of enteric fever took place among the young officers of the Bengal Cavalry, no fewer than four being attacked, with one fatal case. In this instance the infection seemed clearly caused by bad milk, and Surgeon Manifold, of the 4th Bengal Cavalry, told me that he had traced the milk-supply to a village, in which the cows were kept and milked under the most insanitary conditions imaginable. In this case there seems little doubt but that milk was the origin of the outbreak, but in other instances such evidence was entirely wanting. During the spring of 1888 there was quite a rush of cases from the lines of the 17th Lancers and Royal Artillery—some 15 attacks in a very short period. Here there seemed a chance of finding a common cause, and I at once suspected the milk-supply. On investigation I learnt that the regimental authorities had arranged for a flock of goats to be driven round the barracks and milked at the bungalows, and I ascertained that several of the men suffering from enteric fever had refused to drink this milk, and had procured cow's milk from the bazar. I naturally concluded that here, at last, I had got a good case, and that these attacks might be traced to milk. But alas! the very next cases from the same barracks had not drunk milk of any kind, either from goats or cows. So the absolute proof of a common cause at once fell to the ground. Undoubtedly milk is a frequent cause of infection in India as at home, but so long as the supply is obtained from the filthy sources it too often is, there seems little hope of remedying the mischief. Dairies could, of course, be placed under supervision, as piggeries are, and the cantonment authorities could insist on the cows being properly housed, fed, and milked; but the organisation for this purpose is entirely wanting, and with the late abolition of Bazar Sergeants and the substitution of Native Overseers, the subject of a pure milk-supply appears more distant than ever. It is odd, too, how people in this country will insist on cheap milk, 12 to 16 seers to the rupee being the ordinary bazar price; whereas if they would only consent to pay a fair price, 6 to 8 seers to the rupee, a really good milk-supply would be a profitable speculation, and would no doubt be undertaken by respectable European or Eurasian residents.

As regards the sanitation of the barracks and lines, probably nothing is more perfect than the Indian system, if properly carried out. Indeed, the Indian cantonments may be compared to oases of cleanliness surrounded by deserts of filth. Of course now and then carelessness is allowed to creep in and regulations are neglected, but when they are attended to and carried out in their entirety, it would seem almost impossible to improve on them.

It has been suggested to me that the plunge-baths may occasionally be a source of infection; but here also, if the regulations are carried out, there should not be much chance of mischief The plunge-baths are supposed to be emptied out and refilled twice a month, in addition to which the water is ordered to be renewed daily to the extent of one-seventh of the total quantity. If this is neglected, and the water becomes foul, there is then a more than possible cause of infection, as, with 200 or 300 men bathing daily, there must be a quantity of excrementitious matter in suspension, and if any of these men are ambulant cases of enteric fever, the danger is, of course, intensified. I have suggested that to ensure the proper renewing of the water daily, one-seventh of the quantity should be run off by the man in charge of the bath, and if it is refilled to this extent it is evident the water must remain fairly fresh and pure.

CHAPTER III.

PYTHOGENETIC ORIGIN OF ENTERIC FEVER.

THE Suakim Campaign of 1885, alluded to before, affords an excellent illustration of how an apparently healthy force may, in a few weeks, be attacked by enteric fever in its most virulent form. It will be remembered that after the death of General Gordon, it was decided to send an expedition to Suakim, with the object of making an advance to Berber. The idea was to run a railway rapidly from the Red Sea littoral to the Nile, by which our forces would advance to Khartoum, and if necessary, our Nile Expedition could be withdrawn *viâ* Suakim and embark there A picked force of some 8,000 Europeans, composed of three Battalions of specially selected men of the Guards, three Line Regiments, two Cavalry Regiments, a Battalion of Marines, with Field Artillery, Royal Engineers, Commissariat, and Medical Staff Corps, was landed about the middle of March. The Australian Contingent arrived a few weeks later, and with the Imperial troops formed one of the finest bodies of men ever employed in modern warfare. So far as could be ascertained, this force landed in the most perfect health. On the voyage out, the men were inspected daily by the Medical Officer in charge, and all sick were left behind at Suez.

The conditions were as favourable as seemed possible to a complete freedom from disease, yet what was the result? Within two short months bowel complaints and enteric fever in their most virulent forms were so prevalent that from every corps there were numerous cases. The hospitals were overflowing, and the hospital ships were crowded, notwithstanding the fact that nearly 1,000 men had been previously sent away sick and wounded during the few weeks the campaign had lasted.

Now let us inquire into the conditions that caused this state of affairs. First of all, an exceedingly hot climate. As is well known, this portion of the African coast is about the hottest place in the world, and though the expedition was withdrawn before the intense heat commenced, yet while the force was there the rays of the sun were powerful, and the temperature in the tents was very high. The soil was a virgin one, and there is no reason to suppose that any possible cause existed in the sandy desert of the Soudan that could give rise to enteric fever. The very nature of the soil, however, was a factor favorable to the development of enteric fever. Constituted of sand and coral, from the sea-coast to the first range of hills, some seven miles distant, there was absolutly not a trace of clay, and consequently no deodorising or disinfecting constituent. The dry-earth system was nominally carried out, but consisted merely in digging trenches in the sand to leeward of the camps, over which rough latrines were erected. These trenches frequently became to "windward," in consequence of the changes in the direction of the wind; and latterly, on account of the closing up of the camps for protection against the Arab night attacks, the latrines of one regiment became to windward of the next. In addition to this, there was no conservancy establishment whatever provided for the British troops. In this respect the Indian Contingent compared most favorably with the European, as the former came from India completely equipped as for a campaign in that country, and provided with sweepers and other followers who relieved the fighting line of all sanitary duties. The British troops, on the contrary, had to perform their own conservancy work, and as for several weeks after landing the troops were constantly out on convoy duties by day, and harassed at night by attacks of the Arabs, there were really no men available for such labours as attending to the latrines and the general conservancy of the camps. The filth trenches were often in use for days without having the ordure even covered over, and were consequently so malodorous that some of the men preferred to relieve themselves anywhere else than into the trench. Thus the ground became foul in every direction, and the filth trenches themselves were sources of probable infection, being filled with a mass of putrid filth literally moving with maggots. It was often remarked that some of the men were in the habit of sitting smoking over these filthy trenches (perhaps even reading) for much longer than was necessary.

Under these conditions, given one or two mild (ambulatory) cases of enteric fever suffering from diarrhœa, what circumstances could be instanced more likely to spread the disease? I have myself no doubt whatever but that much of the enteric fever of armies in the field is due to this cause, and in future campaigns it would be well to take steps to reduce the risk to a minimum. So far as I have shown, the system of conservancy was, unavoidably perhaps, faulty in the extreme; when added to this was the fact that the trenches were dug in sand, that the filth all over the surface of the ground was exposed to a powerful sun by day, and that the strong sea breeze dessicated and carried the pulverised fœcal matter into the tents, food, water, &c., every "filth" element for the propagation and spread of enteric fever was present.

In consequence of the want of proper food and a sufficiency of water, combined with overwork, the transport animals died by dozens, and early in the morning might be seen the dead bodies of numerous camels, horses, and mules, being dragged out into the desert for disposal. The burial of these animals was generally a mockery, merely a few shovelsful of sand thrown over them, to be quickly blown away by the strong sea breeze that prevailed during the day. As a consequence, the bodies of numbers of animals lay exposed within a small radius of the camp, and I even observed a dead camel, distended by gas almost beyond recognition, lying for several days within 300 yards of the Base Hospital. The stench from these dead animals was simply indescribable, and of course tended to lower the health of all who were exposed to its effects.

The nature of the warfare obliged the military authorities to establish *zareebas* at every post, and these were also undoubtedly a cause of much illness. A *zareeba*, as is known, is simply a thorn fence, about four feet high, placed round the tents to stop the rush of the Arab spearmen, and to protect the camps better, the space enclosed was usually only barely sufficient to pitch the tents in and picket the animals.

My duties as Field Director afforded me the opportunity of seeing all these *zareebas* from Suakim to Otao on one side and to Tamai on the other, and to their unavoidably crowded condition much of the sickness must be attributed. The *zareeba* at Handoop, the first post 11 miles from Suakim, was typical of the rest, and may be briefly described as follows :—

The camp, for strategical reasons, was situated under the lee of a hill about 300 feet high, and, surrounded by a thorn fence, occupied as contracted a space as possible. On this ground were camped Infantry, Cavalry, Transport, Commissariat, Field Hospitals, &c., as close nearly as the tents could be pitched and the animals picketed. This camp was occupied continuously for weeks, so that the sand became saturated by urine, both of men and animals. The filth trenches were dug only a few yards outside the fence, and all round the camp the ground was in many places little better than an open latrine Can it be wondered at if sickness became prevalent among the men—first diarrhœa, and latterly, enteric fever?

It was also remarked that the further the camps were from Suakim the healthier they were, *because the more distant they were the shorter time had they been occupied*, and as a consequence had not had time to get fouled. Military necessities must always take precedence in warfare over sanitary considerations, and therefore the Medical Officer has frequently to silently acquiesce in what he knows will almost certainly be productive of disease. Even from such an example as this a lesson is to be learnt, *viz.*, to open out the camps as much as possible and to shift to new ground when practicable.

The water-supply of the expedition was, in theory, perfect, that is, it was all distilled, and should have been unimpeachable. As a matter of fact, however, it was as bad as it could well be, and there is little doubt much of the disease may be attributed to it.

The harbour of Suakim is merely a gap in the coral formation caused by occasional falls of fresh water from the hills running into the sea, killing the coral insect. The reef projecting out on either side of the out flow of fresh water, leaves a land-locked harbour of considerable depth.

This harbour runs inland, and branches into several small creeks, in which the condensing vessels were anchored as near the shore as possible, chiefly for the convenience of being able to pump the water into the iron tanks on land. When, then, it is considered that this harbour contained a large number of vessels, with a floating population of several thousands, that, in addition, the hospital ships were anchored there, having latterly many cases of enteric fever on board, and that all the excreta of these ships' crews and sick was daily washed on shore by the wind which blew in from the Red Sea, the condition of the fore-shore is better imagined than described. I lived for some weeks in a tent about 100 yards from the beach, a part of my duty being the sanitation of the island. The mud accumulated several inches deep all along the edge of the harbour, and gangs of men had to be employed to scrape it up, take it out in boats and throw it into the sea outside. When this operation was being carried on with the wind "on shore," the stench was so sickening as to cause nausea, the mud being little better than rotten sewage of the foulest description. If, then, it is borne in mind that the condensing ships were taking the supply for their boilers from within a few feet of the shore, the state of the water they were condensing will be understood. In addition, on the surface of the harbour, near the shore, were frequently seen quantities of floating excrement. Theoretically, distillation should have got rid of all these impurities, but practically it did not do so. Many of the condensing ships were fitted with the rudest contrivances extemporised for the occasion, and if the distillation was allowed to proceed too quickly, the sea water was carried over with the steam. In some cases the steam from the boilers passed overboard through pipes bent into a gridiron form, and was thus condensed and carried forward into the tanks on land. The joints of these pipes were often loose, thus permitting the dirty water near the edge of the harbour to pass into the tanks with the condensed steam.

Attention was first drawn to the subject by complaints from the front as to the badness of the water, and from Handoop it was reported that when the bung was taken out of a cask the stench was so great that no one could drink the water. After exposure to the sun, being stirred up and aerated, the water improved and became potable; but there is little doubt much of it was unfit for drinking, having, during the process of distillation, become mixed with excrementitious matter.

It is not perhaps fair to make these statements without qualifying them with an account of the necessities of the situation. When the expedition was sent out, it was believed that water was obtainable at Suakim and in the immediate neighbourhood, and on the maps wells were marked down in several places; but on arrival it was found either they were dry, or the water was saline and unfit to drink. It became necessary, therefore, to supply an enormous quantity of distilled water daily, and I believe 100,000 gallons would be within the daily consumption. Some of the apparatus was extemporised, in addition to which the difficulties of condensing were much increased by the heat of the water in the harbour, it being, near the surface, seldom under 80°, and even up to 90°, during the later weeks of the campaign. It was impossible to send the condensing ships outside the harbour, as, in the first place, there was no anchorage nearer than ten miles, and in the next, there were no means of transporting the distilled water from the ships to the shore. This water then, itself probably contaminated, had to be carried under a burning sun to the different camps, and as the most advanced one, Otao, was fully 30 miles distant from Suakim, the labour entailed on the transport was enormous. The water was exposed for hours to great heat on the way, and on arrival at the camps it was stored, partly in iron tanks and partly in huge canvas bags, in which it became heated to such an extent that the hand could hardly be retained in it. Given organic contamination in the process of distillation, such exposure to heat must have had the effect of further decomposing it, and aggravating the mischief likely to be caused by its use.

Another probable source of disease was the bread-supply.

Complaints having been made as to its quality, a Committee, of which I was a member, was sent to report on its manufacture.

The conditions under which the supply of bread was baked, could hardly be worse. It appears a contract was given to a civilian from Cairo to supply bread, of which a certain proportion—one-third I think—was to be of Egyptian flour, the remaining two-thirds to be of Russian flour. It would have been bad enough had these conditions been fulfilled, but in consequence of the uncertainty of the duration of the campaign and due notice not having been given to the contractor, his supply of Russian flour (which was of excellent quality) ran short. A much larger proportion—probably one-half—of Egyptian flour was being used for the bread. Egyptian flour is bad at the best of times as it is dirty, badly ground and sifted, and frequently mixed with other grains, especially peas. Much of the flour supplied was even worse than usual, being dark, heavy, and somewhat musty, so that it was impossible to make good bread with it. The conditions under which the bread itself was prepared were also objectionable.

We found the bakery situated in a dirty mat-covered shed, close to a foul creek in a corner of the harbour, with evil-smelling liquid mud within a few yards. The water with which the dough was mixed was stored in open casks unfurnished with covers of any kind ; the casks were apparently never emptied or cleaned out, the fresh water being poured daily on what remained in the bottom of each. The water in some of the casks was full of animal and vegetable organism, and so dirty was it that the hand could not be seen if immersed a few inches. The troughs in which the flour was mixed were fairly clean, but above them hung the dirty clothes of the dirtier Arabs employed to knead the dough. The bread, when baked, was placed on boards on the ground to cool, and the loaves were black with innumerable flies. The bread, when cool, was removed to the various camps in the common rope camel nets, not in any way protected by sheets or cloths from contact with them. When it is remembered these nets lay on the ground day and night in the camel lines, exposed to every kind of filthy contamination, the possibility of the bread being a source of disease is more than likely.

The meat-supply was good—Russian cattle chiefly—but when butchered it was exposed to contamination by flies, and was conveyed in carts and on camels in not too careful a manner to the various regiments.

Can it then be wondered at if enteric fever was prevalent among the troops, and whether imported, or of pythogenetic origin, once introduced, that it had ample pabulum for its rapid diffusion. It was well known to the Medical Officers that had the force remained it would have probably become immobile from the excessive number of sick, and had the campaign been prolonged, there is little doubt but that the mortality would have been enormous.

The same story of enteric fever came from "up the Nile," though there the sanitary conditions were of a much more favorable nature. The troops were spread out over a distance of some 1,500 miles; there was an unlimited supply of water, which it is hard to believe could have been badly contaminated, at all events in the centre of the river, and the tinned provisions used, specially biscuit in lieu of bread, were less open to defilement. The same story, however, had to be told, and as far as the troops advanced, so far did enteric fever accompany them. The evidence therefore, of the power of enteric fever to originate spontaneously under favorable conditions, seems very strong.

CHAPTER IV.

THE SYMPTOMS OF ENTERIC FEVER AS OBSERVED IN INDIA.

IT is undoubtedly true that this disease, in India, is often so modified, either by climatic influence, heat, complication with malaria, or absence of some of the recognised diagnostic symptoms as seen in Europe or other temperate climates, as to give rise to much variation, and cause frequent doubts in the mind of the observer as to its exact character. In some the eruption is wanting, though not so frequently as is often supposed, and in very many cases diarrhœa, one of the most prominent symptoms in Europe, is never present throughout the entire attack. So frequently does it happen that young men present themselves suffering from headache and fever, accompanied by constipated bowels, it is necessary to be most cautious, and to avoid giving drastic purgatives, which might inflict irreparable injury, should the disease prove to be enteric fever.

The period of incubation is usually a matter of great difficulty to determine, as in India it is generally impossible to assign any definite cause for the attack, and therefore equally difficult to fix the date of infection. Probably in hot countries the period of incubation is short, as no doubt the body being frequently in a feverish condition, owing to improper diet, excessive use of stimulants, or heat, the intestinal glands are infarcted, and more ready to receive a specific poison. Probably the average duration of the period of incubation does not last over a week ; frequently possibly less. Evidence on this point is much wanting.

The invasion seems to be rather rapid, and though in some cases men do not report themselves for a week or more, I think 3 to 4 days is, as a rule, the usual duration of time that elapses between a person being in perfect health and finding himself obliged to report sick.

The physiognomy, on first coming to hospital, is frequently unmistakeable, and while a great majority of the cases present the circumscribed "pink flush" described by Murchison, a considerable number look pale and exhausted with beads of perspiration on the forehead. When enteric is at all prevalent among young troops, a very considerable proportion of cases sickening with this disease can be almost at once certainly recognised as suffering from it. All young men, therefore, who come to hospital looking flushed or exhausted, should be regarded with suspicion.

The eruption of enteric fever is supposed by many not to be so common in India as at home; but this absence of spots is not so frequent as is believed. In my experience spots, though probably not so numerous as at home, are the rule, not the exception. They must, however, be carefully searched for and marked, as they will often be found on the chest, sides, back, or upper portion of thighs, when not to be seen on the abdomen. It is a good plan, when the ward is dark, to illuminate the skin with light reflected from a looking-glass, when spots that may be faint in color, will be more easily detected. The simplest method of marking the spots is to draw a circle round each with an indelible pencil and date them. If the skin is moist, the pencil will mark very distinctly; if it is dry, the pencil can be moistened before use. The spots most commonly observed are, as a matter of course, those known as "*tâches roses, lenticularis*," or "rose spots," and, as a rule, they present much the same form and color as they do in Europe. I have, however, observed a good many variations, and in some cases there is a tendency to their becoming diffuse, or blotchy, spread out in fact to a larger size. When the weather is hot, and the patient suffers from "prickly heat" it becomes much more difficult to form an opinion, as the "rose spots" become confused and obliterated by the heat eruption. Even then, by carefully marking suspected spots, a correct judgment may be arrived at, as the prickly heat eruption is more persistent, and does not so easily disappear on pressure. My experience is that spots appear sooner in this country than in Europe, as I have often observed them after the fourth or fifth day, judging at least by the man's own admission as to the number of days he had been ill. When the spots are numerous and well marked, the case is frequently of a mild type, and I have often observed the duration and intensity of the fever is in inverse ratio to the amount of eruption. It may also be observed that on the dead body the "rose spots" are never seen, while after death the eruption of prickly heat may be distinctly traced.

"*Tâches bleuâtres*," or slate-colored spots, are much more frequent than is usually supposed. In fact, they are very often not recognised. They were detected in about 8 per cent. of the cases treated in the Lucknow Hospital during 1886, but oddly enough only one doubtful case was observed in 1887, out of 80 attacks. In some instances they were extraordinarily well marked. These spots are about one-quarter to half an inch in diameter, round or irregular, not elevated or disappearing on pressure. They are frequently seen along the course of the superficial veins, and appear like a number of small "*ecchymoses*." These slate-colored spots appear soon after the invasion, and last sometimes as long as the pyrexia, fading gradually as defervescence advances. In some of the cases "rose spots" were seen at the same time, and they were observed both on mild and severe, and even on fatal cases.

The temperature. Murchison says on this point:— "As a rule, from which there are few exceptions, the pyrexia lasts for at least three weeks." No doubt this is the rule in Europe and other temperate climates, but I have seen a large proportion of cases in which the disease has undoubtedly been present, and has abated about the seventh or fourteenth day. I have seen and treated many cases of true enteric fever in India, in which, even allowing the man's statement as regards the number of days he had been unwell before he reported sick to be counted as days of the disease, the temperature has fallen to normal in two weeks, and not a few in which the disease terminated in seven to ten days. The greatest proof that these were true cases of enteric fever was the subsequent debility and anæmia, which were frequently out of all proportion to the severity of the original attack. The temperature in enteric fever in Europe generally rises, in all well marked cases, to 104°, 105°, or even 106° about the end of the first week; but in this country such high temperatures are, in my experience, rare, and, as a rule, when the temperature goes above 105°, the case is one of extreme severity, and frequently proves fatal. I have seen many fatal cases in which the temperature never rose to 105° during the entire illness, and in this country a temperature of 104° must generally be looked on as indicating a severe attack. Again, in Europe a temperature approaching normal during the first week would exclude the diagnosis of enteric fever, but certainly it does not do so in this country; nor does a rise to 104 on the first day, or second morning of the disease as laid down in text-books. Modifications from the effects of heat, or malarial complications, frequently deprive enteric fever in India of some of its diagnostic symptoms as seen in Europe, so that the Medical Officer has often to form an opinion on a case, some of the leading symptoms of which hardly seem to indicate enteric mischief. In the same way, variations of the most erratic nature may be seen all through the course of the disease, and the temperature chart will frequently show falls and rises that would rarely be seen in temperate climates. Some cases jump up to 103°, or even 104°, with a sudden bound, and remaining high for a few days, as suddenly fall to nearly normal. In such cases the fever frequently assumes a remittent type, and for a week, or longer, there may be well marked evening exacerbations with an almost normal morning temperature. Other cases, mild at first, after perhaps becoming normal in the evening, suddenly relapse without any apparent cause, and pass through a secondary attack of a severe nature. Variations in the clinical charts are the rule and not the exception, and it is rare to see cases in which the temperature has run anything like the typical course delineated by English writers. The worst cases as a rule, judging from the charts, are those in which the variation between the evening rise and morning fall is badly marked, that is, the nearer straight the temperature line remains, the worse the attack; a temperature continuing for several days between 103° and 104° is generally an indication of a grave condition, more particularly if the rise is inverted, that is, is higher in the morning than in the evening.

During the great heat of summer when the temperature of the wards ranges between 85° and 90°, the tendency to hyperpyrexia is frequent, and many cases terminate fatally from congestion of the brain, or effusion. The tendency to a rise in temperature as a consequence of excitement, undue exercise, or improper food, after apparent convalescence has been established, is very common. I have lately seen a case in which the temperature had been normal for fully three weeks,—and the man had been for days on meat diet preparatory to discharge,—suddenly jump up to 104°, consequent on the excitement caused by a promise of being discharged from hospital. Several others also, after actual defervescence had taken place, and the temperature had been normal for ten days or more, on removal to the general wards to make room in the enteric wards, suffered from well marked relapses, due possibly to the movement, but more probably to eating some forbidden article of food obtained from a comrade. In India, therefore, we must be prepared for variations of temperature of the most unlooked-for kind, and it is well to remember that the severity of the disease cannot always be judged by the indication afforded by the thermometer, as frequently the chart of severe, and even fatal cases, does not, when taken alone, indicate the danger of the attack.

The pulse in enteric fever, in India, is perhaps the one symptom that differs least from European experiences. If anything, it is probably a little faster, as a rule, as might be expected from the influence of climate.

The respiration is generally rather quicker than in Europe, ranging on an average between 25 and 30. However, pneumonia and bronchitis are not at all so frequently seen in India as in Europe, where, in my experience, especially in cold weather, the greater part of the mortality is the result of lung complication. During 1886, out of 105 cases very few instances of lung congestion or bronchitis were seen; whereas in 1887, out of 80 cases a considerable number suffered from this cause, and several deaths took place from pneumonia.

The tongue presents many varieties of appearance in this country, and I have observed three distinct types. In the milder cases the ordinary furred, creamy looking centre, with bright red margin and tip, was the most common in the severer forms ; a bright red, glazed tongue was frequently seen, and in some instances there was little or no variation from this condition during the height of the disease ; while in the worst forms, the brown, dry, typhoid tongue, often thickly coated, and sometimes cracked, fissured, or even deeply ulcerated, was frequent. In one case I had under treatment, a ragged ulcer ate away one side of the tongue to such an extent, that there was much danger of its eroding the lingual artery, and a good sized walnut might have been fitted into the gap. These conditions are not by any means constant, and I have seen cases commence with the usual coated tongue, with red edges, pass on to the red, glazed condition, and finally end in the typhoid state, with deep fissures. The severity of the disease is not always indicated by the condition of the tongue, as in some very severe cases it hardly becomes dry, while in others, in which the disease ran a fairly mild course, the state of the tongue, taken alone, would have been indicative of great constitutional disturbance.

Lips and teeth. In severe cases the lips are parched, sometimes even cracked, and the teeth become covered with sordes, but I have never seen hæmorrhage from the gums in any instance.

The appetite is not nearly so frequently lost as is the case at home. Murchison states he has only observed it present in 11 out of 100 cases. As a rule, even in the severer cases, there is comparatively little difficulty in getting the patients to take sufficient nourishment. In fact, in this country, marked loss of appetite appears to be the exception. When patients are convalescing, and even before defervescence is complete, the appetite is often so ravenous that there is the greatest difficulty in preventing them eating improper articles, and severe relapses from this cause are not at all uncommon.

Thirst, as might be expected, is generally severe, and is present in the majority of the cases.

Meteorism is not very common in India, and, whereas according to Murchison, nearly 80 per cent of cases suffer from this symptom in Europe, its presence, to any extent at least, is rather the exception, than the rule, in India.

Gurgling in the right iliac region is one of the commonest diagnostic symptoms I have met with, and in seventy consecutive cases I detected it during the first week, in greater or lesser intensity. In fact, the absence of gurgling is very rare, and so well marked was it in many instances, that it was distinctly audible to bystanders, when pressure was made over the right iliac fossa.

Marked enlargement of the spleen is not at all so common a symptom as might be looked for in this country. Why, it would be difficult to say, but as most of the cases occur among new arrivals, the spleen is seldom enlarged beforehand. Perhaps the spleen acting (as some suppose) as a diverticulum for the blood, is not so much called into action as it is in a cold climate, in consequence of the greater activity of the surface circulation in a hot country At the *post mortem* examinations any very extensive enlargement of the spleen was seldom seen, though in many cases it was congested, of dark color, and friable.

Diarrhœa is the rule in enteric fever in Europe. In India I would almost say it was the exception. Constipation, on the other hand, was present in a considerable number throughout the attack. Murchison states that in only 7 out of 100 cases observed before 1862, it did not exist during any stage of the disease, but that subsequent observations indicated its presence in about four-fifths of the adult cases. In India I should say that marked diarrhœa does not exist in a many as one-half of the cases, and in very few is it severe or constant. In many it lasted only a few days, or alternated with constipation. In only about five per cent of the attacks was astringent medicine required, and that only occasionally. On the other hand, constipation is very common, commoner by far than marked diarrhœa, but when laxative medicine was given, generally castor-oil one to two drachms in hot milk, the motions were usually of the characteristic ochreish color. The absence of diarrhœa is, no doubt one of the chief difficulties of diagnosis in India, as looseness of bowels, with the typical pea-soupy stools, is such a frequent characteristic of the disease as seen in Europe, that some observers are apt to doubt their diagnosis if it is not present. I have lately been consulted about the case of a Medical Officer at another station, who, judging from his temperature chart, had passed through a long and well marked attack of enteric fever, but as constipation with bilious vomiting was constant all through the first three weeks, neither he, nor his medical attendant, believed it to be enteric. He was in consequence treated with drastic purgatives, quinine, and too much solid food, under the supposition that it was an attack of remittent fever. As a natural consequence he suffered from a rather severe relapse due, no doubt, to the irritation caused by the food and purging, though he subsequently recovered.

The character of the stools in enteric fever in India, when diarrhœa is present, is the same as in Europe, and the pea-soupy ochreish appearance is generally well marked. When constipation is present, these characteristics of course disappear, but when the bowels are moved by laxative medicine the motions are frequently typical.

Intestinal hæmorrhage is, in my experience, in some outbreaks, exceedingly rare, and out of 105 cases treated in the Lucknow Station Hospital, in 1886, it was hardly ever observed, and no deaths took place from this cause. In 1887, however, out of 80 cases, there were numerous attacks of hæmorrhage, some very severe, and several fatal. While during 1888 out of 60 attacks, there were only two cases of hæmorrhage.

Epistaxis was very common, and a very considerable proportion of cases suffered from it during the hot months, generally within the first few days, sometimes even at intervals throughout the attack. Epistaxis is not usually an unfavorable symptom. On the contrary, it appears to relieve the patient, and is generally followed by a fall in temperature. In one case severe hæmoptysis followed, which reduced the patient exceedingly, and had to be treated very actively before it was checked.

Headache is almost invariably complained of, usually frontal, but sometimes general, especially at the onset of the attack.

Vertigo is also nearly always present to a greater or less extent, in the first stage of the attack ; in fact, in nearly every instance, men reporting sick, complain of giddiness and frontal headache.

Pain in the back and loins was frequent, but not usually severe. Men complained more of weakness and soreness than of actual pain.

Delirium is, on the whole, an infrequent but dangerous symptom, and a very large proportion of the cases passed through the disease in this hospital without any marked disturbance of the mental faculties. Of those cases of delirium that did occur, most of them were more mental confusion than actual delirium, and few were at all noisy or troublesome. In five or six cases in which head symptoms, probably induced by the heat, proved fatal, most of the patients were easily controlled, and only a very small proportion were at all violent. During 1886 death resulting from head symptoms were much the most common, pneumonia being comparatively rare, while in 1887 bronchitis and pneumonia were rather frequent, and several deaths took place from these causes.

Wakefulness was often present, but, as a rule, was easily overcome by means of bromide of potassium and chloral hydrate.

Somnolence was rare. At least to any marked extent, though a good many cases exhibited considerable drowsiness when first admitted.

Prostration is constant towards the end of the case, though not at first generally well marked. On the contrary, there was frequently much difficulty in keeping men in bed during the early portion of the attack. Some patients gave considerable trouble in this way, insisting on being able to go to the ablution room and latrine, which, for the sake of the other patients using the same accommodation, was strictly prohibited.

The decubitus, when permitted, is generally dorsal, but I make it a matter of routine treatment to keep patients, as much as possible, on their sides.

Muscular paralysis. In a few cases the stools and urine were passed involuntarily, but in most instances not till the patient was in a dying state. In one or two cases, however, in which these symptoms existed for some time, the patients made good recoveries. Inability to protrude the tongue was seen in many severe cases, especially when the organ was dry and cracked, but in none of the cases was dysphagia complained of.

Organs of hearing. A very large proportion of the men who reported sick with enteric, complained of dizziness, and a considerable share of these stated also they had noises in their ears. Deafness during the progress of the case was frequently observed, but not so commonly, I think, as in Europe, and in none of the patients did deafness continue after convalescence.

Cutaneous sensibility was well marked in a few cases, and in one of those in which the *tâches bleuâtres* were present, the hyperœsthesia of the skin was extreme, the slightest touch with the nail on the abdomen causing the muscles to be thrown into strong action.

Emaciation was well marked in almost every case; in some it was extreme, and out of all proportion to the severity of the orignal disease. In fact, in some doubtful cases, in which the fever ran so mild a course as to leave the diagnosis doubtful, the subsequent debility and emaciation helped to confirm the opinion as to the nature of the attack.

As a rule, men who have passed through a fairly severe attack of enteric fever remain at least two months, or even more, in hospital, and are seldom fit for the duties of a soldier for two months more after discharge. The theory that a soldier must either be at "duty" or "in hospital," if carried out after an attack of enteric fever, would be most pernicious, as, after two or three months' illness, the muscles are soft and flabby, the tone of the system is below par, and it is quite impossible that a soldier, under such circumstances, can be fit to return at once to the ranks and do his duty. If such a thing were insisted on, the man would either faint from exhaustion, when any strain was put on him, or if he had sufficient pluck and muscular power to carry him through, he would most likely develope palpitation, or dilatation of the heart, as a result of using muscles quite unfitted for prolonged exertion. It ought then to be an invariable rule that all cases convalescent after enteric fever should be discharged to "light duty," should be seen weekly, and treated with tonics, till such time as they are quite fit to return to the full duties of a soldier.

* * *

CHAPTER V.

THE STAGES.

The stages of enteric fever in India seem to be much the same as in Europe. The disease, as a rule, terminates by "lysis," but in some instances I have observed a distinct "crisis," the temperature suddenly dropping from 102° or 103° to normal, in 24 or 48 hours.

Convalescence is said, in text-books, to be fairly established when the temperature is normal for two successive evenings, and no doubt in many patients this is the case, but in a very large proportion relapses, of greater or less severity, occur after the temperature has been normal for many days. Even after 10 or 14 days, and sometimes longer intervals of apparently complete convalescence, relapses take place, some of them of a most severe nature.

Duration. In Europe the ordinary duration of enteric fever is from three to four weeks. In nothing perhaps is there greater variation than in the duration of the disease in India compared with that at home. I have seen two men report sick on the same day with identically the same symptoms; one of these was convalescent in a couple of weeks, while the other passed through a long and severe attack. It is frequently quite impossible to predicate the probable severity or duration of the disease in this country. Cases that are mild at first, and after a few days appear convalescent, suddenly relapse without any apparent cause and pass through a long and dangerous illness. On the other hand, cases that, when admitted, appear likely to be exceedingly severe, suddenly abort and become convalescent in a week or two. Many slight cases do not last longer than 7 or 10 days, while others last 30, 40, 50, and in one instance I saw the disease continue for 65 days, without the temperature once falling to normal. Cases terminating fatally very rapidly are rare, and I have only seen one terminate by death before the end of the first week. This is probably due to the absence of any intense specific poisoning, such as occurs in Europe when foul sewers or cess-pits are opened, and the patient is overwhelmed by the virulence of the poisonous gas.

Relapses have already been alluded to, and it is sufficient to say now that this is one of the greatest dangers to be looked for in the course of an attack of enteric fever in India. I think that no case can be pronounced absolutely safe from relapse till the temperature has been normal for at least three weeks, and even then cases that have apparently quite recovered, suffer from pyrexia that would appear to be due to the enteric lesions not having completely healed, and becoming irritated by improper food, or overexertion. Relapses frequently take on a typically remittent form, and if only the latter part of the chart was regarded, the disease would certainly be looked on as malarial. When the fever during a relapse is of the remittent or intermittent type, it may possibly be due to malarial complication, and large doses of quinine, administered two hours before the expected rise, seem to exercise a distinctly curative effect.

Complications. Bronchitis is not nearly so common as in Europe, at all events in the warm weather.

Pneumonia, which in my experience causes the larger proportion of deaths among soldiers at home suffering from enteric fever, is not generally so frequent or so fatal in India. A considerable proportion—probably 20 per cent.—of the cases suffered from congestion of the lungs to a greater or lesser degree, but deaths from pneumonia were not so frequent as in Europe.

Hypostatic congestion was often present, especially when the patient was permitted to lie on his back.

Pleurisy occurred in a couple of cases, but was not severe.

Tubercle of lung followed in one or two cases. It was ushered in by severe hæmoptysis, and rapidly passed into well marked phthisis.

Laryngitis, *general eruplysema*, or *pneumo-thorax*, were not observed in any instance.

In no case did any marked disease of the organs of circulation follow the attack.

Meningitis.—About 8 per cent. of the cases were attacked by meningitis in 1886, and in nearly every instance proved fatal; while in 1887 there were but one or two instances.

I have observed that while in Europe pneumonia is frequent and meningitis rare, exactly the reverse takes place in India. This difference is no doubt due to the temperature in which the cases are treated; for, while at home, it was difficult, in winter, to keep the wards up to 50°, and I have seen them as low as 43° during a severe frost, in this country the difficulty is to keep the temperature down. The air in the wards ranges from 82° to 88° during the hot months, notwithstanding every precaution being taken to keep them cool.

Mental imbecility and mania were never observed, nor did paralysis follow any attack.

Deafness during the attack was common, but it never persisted after convalescence.

Dysphagia due to pharyngitis was never observed, nor did *vomiting* occur during convalescence.

Diarrhœa was rare as a subsequent symptom, but *dysentery* followed in several cases when apparently quite convalescent. I have also seen instances in which dysentery was the first symptom of the disease, and was co-existent with the enteric attack.

Jaundice was never observed, nor did peritonitis occur except as a result of perforation in a few instances. In my experience perforation is rarer in this country than in Europe. In only a few cases in India, out of some hundreds, have I seen perforation of the bowel. I lately read a casualty report in which a man in hospital, in another station, suffering from some slight affection, died suddenly from perforation of the bowel, and judging by the *post mortem* examination, the case would seem to have been an ambulatory one of enteric fever. Cases of perforation take place in India occasionally, and I have seen several *post mortems* in which the ulcers had eaten through everything but the serous coat of the bowel. But, on the whole, such instances are rarer than in Europe. Death from perforation, or indeed any actual enteric lesion, is comparatively rare.

Diseases of the urinary organs are infrequent, excepting that albumenuria occurred in several cases, mostly when convalescing. In none of the cases was the disease persistent, and it readily yielded to appropriate treatment. In no case did dropsy result.

Hœmaturia or *catarrhs of the bladder* were not observed.

Varieties of enteric fever. Murchison says, "no acute disease presents itself under a greater variety of forms than enteric fever," and no doubt this is to a great extent true also of the disease as observed in India.

The *abortive form* is much more frequent than is generally admitted, and numerous cases are returned as simple continued fever, ague, or remittent fever in this country, because the disease aborts during the first seven or fourteen days. The proof that these cases are really enteric lies in the fact that many, which apparently at first aborted in an exactly similar manner, suffered from severe relapses: the disproportionate debility and anæmia that nearly constantly followed these attacks, was also remarkable.

The number of ambulatory case of enteric fever is much greater than is often supposed; and this alone ought to make medical officers most suspicious of all cases of fever, no matter how trivial, occurring among young soldiers. Setting aside the enhanced risk to the patient himself, the unsuspected ambulatory case may be the cause of infection, of many others through the latrines. In such a climate as this, with a temperature for months so high that meat killed in the morning is putrid by night, what wonder is it if a neglected enteric motion in an unemptied pan cause disease in others using the same latrine. There is little doubt but that this was an important factor in the outbreak at Suakim in 1885, which I have alluded to elsewhere. There are mild forms of every disease, and to illustrate this, I may quote instances I saw in an epidemic of scarlet fever in Dublin, of cases so mild that nothing but the knowledge of the prevalence of the disease in the barracks induced me to diagnose them as such, yet, in several, well marked albumenuria followed. One case I particularly remember. A fine young man of the Royal Horse Artillery reported sick because he could not button his jacket and trousers, the fact being he was dropsical and suffering from acute nephritis. This disease was, undoubtedly, from the man's own admission, a sequel of a mild attack of scarlet fever, during which he had never gone sick and had done his duty as a Horse Artillery soldier throughout. When such instances are numerous in other fevers, why should we so often doubt the presence of enteric fever because all the symptoms are not present, or are so in a very mild form. Such cases in civil life, where the powers of discipline cannot be exerted, frequently prove fatal, but in military hospitals the patients are placed under the best possible conditions, especially if the true nature of the disease be recognised in time, and recovery should generally be assured.

The *gastric* form is not common in this country; vomiting and bilious derangement are the exception, and not the rule.

The *acute* form in which the patient dies rapidly, overwhelmed by the virulence of the poison, is seldom seen: probably, as stated before, on account of the absence of sewers or cess-pits to provide materials for intense poisoning of the system.

Infantile enteric fever among European children is rare, which may be the result of their not being exposed to sewer or cess-pit emanations: nor do children, as a rule, visit the native bazars. Whether enteric fever is, or is not a common disease among native children, is still an unsettled point Hitherto the evidence seemed to indicate that enteric among the non-meat eating native population is rare, but later observers, more especially Surgeon-Majors Cleghorn and Holmes, I.M.S., who have had much experience on this subject, seem now to regard enteric fever among natives as a very common disease, and think it possible, if not probable, that many native children pass through unrecognised attacks during early life.

CHAPTER VI.

PROPHYLACTIC MEASURES.

PROBABLY no greater evidence could be adduced of the difficulties that stand in the way of prophylactic measures in the country than the following passage from Murchison, page 648 :—

"Instead of cutting off thousands annually, enteric fever would be a rare disease if we could prevent the products of fœcal fermentation entering our houses, and polluting our drinking water."

Here, then, is the opinion of one of the most eminent authorities on fever, laying down as an axiom that air and water contaminated by the products of fœcal fermentation, are the main causes of enteric fever in temperate climates. How far can such causes exert their influence in barracks in India? Theoretically, not at all. There are no water closets or sewers to generate sewage gas. The dry-earth system, if properly carried out, ought to render the presence of fœcal matter in a fermenting state impossible, and the water-supply ought to be, and usually is, above suspicion. If Murchison's principal factors—"foul air and polluted water"—are in existence in any barrack in India, it is only because the regulations of the service are not strictly carried out: as, if they are, impure air and water would appear to be impossible. Of course, as pointed out previously, the sanitary condition of the Continent of India, outside cantonment limits, is very bad, and the total absence of village sanitation permits of vast quantities of fœcal matter being dessicated by the sun and carried by the wind in every direction. This, however, is a constant condition, and there is no evidence to show that it injuriously affects the general health of European residents in cantonments. Even if there were direct proof of the insanitation of the native population injuriously affecting the garrisons of India, it would be utterly hopeless to look for any improvement under this head to an appreciable degree; at all events for many generations to come. The native of India, may, in time, be educated to better things; but at present improved sanitation is outside the limits of practical politics. What then can we do, from a prophylactic point, to reduce the sickness and mortality from this cause?

First, we must exercise an endless vigilance over our sanitation in cantonments, and our efforts in this direction must never be relaxed. The regulations are very clear and explicit, and if thoroughly carried out, should be most effectual. Ventilation, sanitation, water-supply, food, clothing, bedding, duties, &c., are all provided for, and little of any practical value remains to be suggested in these particulars. To what additional points should we then direct our attention?

As shown by Bryden, and as indeed is recognised by all who have experience of enteric fever in India, "recent arrival" and "youth" are two great factors. As regards "recent arrival," we can have no control. The Army in India must be kept up, and, as a result of losses from death, invaliding and discharges, a constant flow of young men must arrive yearly. It has been clearly proved that the great bulk of the cases, over 64 per cent, occur in men of under two years' residence. If then we could place all young, newly-arrived soldiers in such a position as to minimise the attacks during the first two years of residence, there would be some hope of the after-number of attacks being less numerous, that is to say, a form of acclimatisation would take place, and at the end of the second year of residence the liability would fall considerably. The only possible solution of this problem would seem to lie in at once sending all newly-arrived young soldiers to well selected hill stations, and acclimatise them there.

A remarkable instance of the effect of such a proceeding is related in the Sanitary Commissioner's report for 1886, page 35. In my annual report on Lucknow for that year, when commenting on the outbreak among the lately-arrived drafts from England, I wrote:—" In addition to the cases (105) that occurred here, mention must be made of the fact that considerable portions of the lately-joined drafts were sent to Ranikhet to a summer camp, and that the disease was very prevalent among these men about the same time; in fact, the two outbreaks ought to be added together to give a just estimate of the actual number of admissions from among this class." Surgeon-Major Knox, in his annual report on Ranikhet, stated :—" The station was absolutely free from enteric fever when the young soldiers for the standing camps commenced to arrive on the 22nd April, but it was soon apparent that they had brought the disease with them, as three cases were admitted before the 30th of April."

In all, there were 46 cases from the camps, out of a strength of 400, while the East Surrey Regiment had only 14 cases out of a strength of 850. Surgeon-Major Knox further remarks :—" I would here mention a remarkable fact, that a draft of 85 men, very young soldiers, who arrived to join the East Surrey Regiment at the end of last January from England, gave only one case, although with regard to age and Indian service they were exactly on the same footing as the troops in the summer camp." Surgeon-Major Knox attributes these results "to some local influence in the camps," and concludes:—"The water-supply was the weak point in the arrangement;" giving his reasons for so concluding, *viz.*, that the "supply was scanty," and that forbidden sources were used, also that the filters were "worn out and useless."

Surely, a close examination of these facts may guide us to other conclusions? When but one out of 85 was attacked in one body of men, while 46 out of 400 were attacked in another body, something else than a scanty water-supply and worn-out filters must be held to be the cause. It must be remembered that these two bodies of men were located only some two miles apart, and there is little doubt but that many of the East Surrey visited the standing camp frequently, and drank there of the same water-supply. Had the two bodies been absolutely isolated from one another, then indeed the evidence of an impure water-supply might be accepted; as it stands, there is little doubt that many of those who escaped drank frequently of the water in the standing camp. It must also be remembered that, simultaneously with the outbreak at Ranikhet, the remainder of the same body, *viz.*, the lately-arrived drafts, were suffering in a similar way at Lucknow, where the water-supply was above suspicion. I have little doubt, moreover, that had the 85 men of the East Surrey Regiment, that escaped with but one attack, been kept at Lucknow till April, and had then been sent up to Ranikhet, they would, in their barracks, and with the better water-supply, have suffered just as severely as the remainder of the drafts.

Some years ago a recommendation was made by the Surgeon-General, to the effect that a British Regiment should be sent direct to Ranikhet on its arrival from England. The 2nd Queen's was selected for this purpose, and when I saw the regiment as it passed through Cawnpore, I remarked on the very youthful appearance of the men, and how likely it was that many of them would fall victims to enteric fever. This regiment suffered severely at Ranikhet, having, I think, had some 70 cases of enteric fever in the first year. Now, had this case been taken as an illustration of the value, or otherwise, of sending freshly-landed troops to the hills, the system would have deserved instant condemnation, but the weak link in the chain has yet to be told. On account of military considerations, this regiment was halted in camp, at Bareilly, for some weeks. Enteric fever appeared there among the men, fresh cases occurred on the march, and the regiment arrived at Ranikhet an infected body, exactly as the men for the summer camp arrived from Lucknow.

What lesson should we then learn from these instances? The answer unquestionably is, that all drafts of young soldiers and all newly arrived regiments should be landed as early as possible in the cold season, and sent, with the least practicable delay, to a thoroughly sanitary hill station. No halting or delay on the road should be permitted, and the men should be taken from the trooper, by train, as fast as possible, to the point nearest to the hills to which the rail runs. Even stopping at Deolali should not be allowed, as, judging by the rapid appearance of enteric fever among young men just out from home, I have little doubt but that many cases are contracted at Deolali, or in the other camps along the line of rail. To be fairly and properly conducted, such an experiment as the above would require close attention to detail. The men should be carefully observed on the voyage out, and all suspicious cases isolated and left behind at Bombay; no halt should be made at Deolali. At other camps the men should be confined within their limits, and the utmost attention paid to all the sanitary surroundings, water-supply, &c. On arrival at Bareilly, or any other terminus, the drafts or regiments should be at once removed well out of risk of infection, and the same precautions observed on the line of march, so that, as far as human foresight could obtain, the young men should arrive at the hill station as free as possible from any risk of infection on the road. If, after this experiment had been carefully made, enteric fever appeared, there is little doubt the disease would be due to local causes; but till the experiment has been carried out thoroughly, the question will remain an undecided one.

The second factor, "youth," is also now thoroughly recognised, and the Sanitary Commissioner's report proves that the percentage of liability of men under 25 years of age is over 63; in fact, almost identical with the percentage of liability during the first two years of residence. There is little to be said on this subject, as Government must send out young soldiers to keep the army up to its strength; but the principle has been recognised, and under the present order, recruits under 20 years of age are not to be sent out from home. It is now a well recognised fact that the "old soldier" of bygone days is not the most efficient in the field, and that between the age of 23 and 30, men are, speaking generally, in the highest physical condition. Under 23, men are not fully developed, and are liable to enteric fever in an undue ratio. Above 30, men begin to suffer from heart and liver complaints, while activity and dash, so necessary in the rapid campaigns of the present day, have commenced to deteriorate.

Having dealt with these well recognised factors, there is little more to be said regarding practical prophylactic measures. So long as there are bazars, so long will young soldiers resort to them, and if (as seems possible) enteric fever is a disease of the native population, there will always be the chance of infection taking place through impure water, milk, ærated drinks, &c.

The next prophylactic measure I can suggest is an improvement in the milk-supply; and even if the Government is not prepared to have milk supplied from dairies under official supervision, yet much might be done by a regular inspection of the villages in which cows are kept, and a supervision of the conditions under which they are milked. It should be quite feasible to license milk suppliers to the troops, and to compel the cow-owners to keep and feed their cows in sheds in cantonments. The milk could then be distributed under regimental arrangements, and severe punishment meted out to milkmen detected selling any other milk within the cantonment boundary. It would be necessary, however, to fix a fair price, as it is quite impossible good milk, from well-fed cows, can be sold at the usual bazar rate of 12 to 16 seers per rupee. Pure milk supplied at 8 or 10 seers per rupee would be far cheaper in the end. Even if the cows are fed under strict supervision, and milked under the superintendence of orderlies, adulteration is not only possible, but frequent. The milkmen of India are adepts at deceit, and few people who have not had intimate acquaintance with their schemes and dodges, have any idea how they adulterate milk under their very eyes. One of the commonest plan is to have water in the *lotahs* into which the cows are milked. Another plan I detected myself, was certainly ingenious, and deserved success from its originality. The hospital milk was invariably bad, though the cows were well fed, all the vessels examined before the milking commenced, and the process carefully watched by orderlies. I at last discovered that the milkman had a small *mussuck*, or leather bag, concealed in his clothes, and from this *mussuck* a narrow leather tube led down the man's sleeve into the palm of his hand. As he milked the cow, he squeezed the water, by the pressure of his arm against his side, into the pail with the milk, and literally *milked water* into the pail under the very eyes of the orderly set to watch him.

In the Lucknow Station Hospital the cows are milked under the supervision of orderlies detailed for the duty, and written orders are in force, which, if followed, must prevent such tricks. Even then the milk contractor has attempted several times to substitute bad milk for that milked from the cows, with the invariable result of detection, followed by a heavy fine. When such organisation is required to procure pure milk for a hospital, what wonder is it if milkmen, when under no supervision, supply milk of inferior description.

Next, the general question of rations and means of cooking require consideration. During the hot season the amount of meat might be reduced, and rice or other farinaceous food substituted. The meat should be made into good nutritious soup, with plenty of rice, barley, or vegetables boiled in it, and the present system of allowing men to eat tough steaks cut off their rations for their breakfast, ought to be discouraged.

Soldiers' gardens for the supply of fresh vegetables should be made universal, as if men could get good salads,

&c., with their breakfast, they would not care so much for meat.

There is also no reason why jam should not be much more largely consumed than it is. There are plenty of excellent fruits in India, from which most palatable jams are made, *e.g.*, Cape gooseberries, citrons, mangoes, guavas, &c. From all these, excellent preserves can be obtained at very trifling cost. Under regimental arrangements the men could be provided with cheap and good jams all through the year, which would not only satisfy appetite, but be wholesome, easy of digestion, and act as anti-scorbutics. In the Soudan, the troops consumed enormous quantities of jam, and the various camp grounds at Suakim were strewn with tins bearing "Moirs'" or "Cross and Blackwell's" labels. This was simply the result of instinct, and the gratification of the appetite for anti-scorbutic food. In a similar manner would the European soldier in India consume fruit preserves if placed within his reach, with benefit to himself from a dietetic point of view, and ultimately with a gain to the State as a result of improved health?

In a similar way much might be done to remedy the horrible habit, so common to the European soldier, of drinking excessive quantities of malt-liquor. The open canteen system, while preferable in some way tothe old plan of allowing each man a fixed quantity daily, in that it induces men to spend their money on wholesome drink, instead of purchasing poison in the bazar, has the disadvantage of affording them the opportunity of consuming quantities of malt-liquor limited only by the extent of their resources. It is within my knowledge that some soldiers make a habit of drinking every farthing of their pay, and I have had young men confess to having consumed over ten pints of beer at a sitting; some even more. Men first visit the canteen with the object of quenching thirst, and then go on, partly from bad example, partly from idleness or vice, to drink till they can pay for no more, or are removed to the guard-room intoxicated. How far such excess predisposes to disease it would be difficult to say, but there is little doubt that everything that causes indigestion, or congestion of the intestinal tract, must, more or less, be a factor favorable in the development of the enteric poison. The object then to be gained is the best method of satisfying thirst with the minimum injury to health. In each barrack there should be a supply of iced, machine-made ærated liquids—soda-water, gingerade, lemonade, &c., and these could be sold at remunerative prices with benefit to the men. In the same way, at the canteen, iced effervescing liquids should be on sale, and men should be encouraged to mix them with their beer, ice in lumps being available for those who desire it. "Shandy-gaff," *i. e.*, beer and gingerbeer in equal proportions, well iced, might also be kept ready, and would probably meet with a ready sale. It stands to reason that if men could get an agreeable cold drink, most would prefer it to warm, heavy beer that does not satisfy thirst. There probably would at first be little difficulties in the way, as canteen profit would be interfered with, and probably canteen sergeants would not care for the trouble of such new-fangled ideas; but perseverance would override all opposition, and after a little, a large proportion of men would come to prefer a light, cool, wholesome drink, to heavy, warm beer that did not satisfy the thirst, and cost them far more in the end both in health and pocket.

The waste of fuel under the present system of cooking is enormous, and if proper ranges were provided, the saving in the item of wood alone would well repay the original outlay. These ranges should be fixtures, and should be taken over by succeeding regiments, any unfair wear being made a barrack damage to the outgoing corps. With ranges of this kind the cost of cooking to the men would be largely reduced, as the cooks, who are paid by the companies, would be considerably reduced in numbers. The cooking would also be infinitely better and more appetising. The *deckchies* or camp kettles could still be kept for camp purposes, and a number of the men should be trained to cook, both with the ranges and the Indian appliances. In the cold season, most of the company cooking could be done by the men themselves, while in the field they should be as independent as possible. The fact is, the British infantry soldier is far *too pampered and idle* in this country, and if he were obliged to do a little more for himself it would be to his own gain, both in health and pocket. Hitherto there has been an absurd idea prevalent that it is "degrading" to the European in India to have to perform manual labour, so that the soldier seldom even blacks his own boots, or shaves himself. How much better would it be, at all events during the cold season, if the soldier in this country had more real work to do; for instance, whitewashing his barracks, digging drains in and about his lines, filling up hollows, digging a supply of dry earth for his latrines, drawing his drinking water, and even occasionally washing his own clothes. If trained in this way, his muscular powers would be developed, and on active service he would be much more independent of the array of native followers that now encumber the movement of an army. In like manner the soldier should be employed in the repairs of his barracks, &c., all of which work he could do to his own physical and pecuniary advantage.

Absorption wells.—The question of getting rid of the soapy water from the lavatories in barracks and hospitals is also one of much greater difficulty than at first might be supposed. In Lucknow, for example, there are nearly 3,000 Europeans, counting in the married families, and, allowing only one gallon a head per day (an estimate far below the truth), it is evident that some 3,000 gallons of lavatory water has to be got rid of.

Three systems present themselves :—

I.—Removal to a distance, either by hand, in tank-carts, or by pipes ;

II.—Letting the soapy water run out into gardens, or, failing gardens, into a small plot of ground set aside for the purpose ; or

III.—Running it into "absorption pits."

The first system would, no doubt, be theoretically the most perfect, but the mere consideration of the expense involved will at once set it aside as impracticable.

The second system would also be efficacious if it could be worked efficiently, but, in the first place, soldiers' gardens are the exception, and not the rule, and in such a station as Lucknow, it would be utterly impracticable to have them in sufficient numbers. Again, the plan of running the water from the lavatories into dug-up patches of ground reserved for the purpose, is objectionable in many ways, as, if not constantly turned over, the land becomes saturated, and may be an element of danger. Moreover, the soapy water attracts innumerable flies on account of the slimy deposit left by the soap after evaporation.

The third system of running the lavatory water into absorption pits answers admirably, and in my experience is quite unobjectionable.

It may be as well to describe the construction of an absorption well, or pit. A pit is dug at a convenient distance from the lavatory, say 30 or 40 feet, to a depth of 10 or 12 feet, with a diameter of about 5 feet. The bottom of the pit is filled with broken bricks to a height of about three feet, and a brick shaft leads from the surface down to these broken bricks. The rest of the pit is then filled in with earth, and a quick-growing tree planted in it. The water from the lavatory is led by means of an open brick drain to the shaft, the mouth of which is protected by a grating, which prevents leaves, grass, &c., passing down the shaft. The soapy water runs down among the broken bricks, on which a slimy-looking deposit takes place, the water being partly absorbed by the roots of the tree, and partly by soakage into the surrounding ground. It will be observed that nothing in the form of sewage or organic matter, beyond the dirt from the surface of the men's bodies, can enter these pits, and as this trifling amount of organic matter is mixed with soap, it becomes thoroughly aseptic.

An outcry against the use of these pits has been raised by some few observers who had seen them on first being opened, when an undoubtedly ugly looking slime was thickly coated over the bricks at the bottom, but this slime, when exposed for a few hours to the air, dries into an impalpable grey powder, free from smell, and perfectly innocuous. These pits are always located as far as possible from potable water wells, and if the fact be remembered that a well drains an amount of ground, in the shape of an inverted cone, the diameter of the base of which is equal to the depth of the well, it will be seen that a well 40 feet deep, situated 150 to 200 feet from an absorption pit, is practically safe from contamination, even if the pits contained actual sewage. To test this point more accurately, I had water taken from two wells, situated 18 and 25 feet, respectively, from absorption pits (the wells in question were not used for drinking purposes), and carefully analysed, and in each instance the water was declared absolutely free from organic matter. This, I submit, sets at rest the question of risk of contamination of potable water by absorption pits. In fact, I consider these pits to be the simplest, safest, and cheapest method of getting rid of the lavatory water in all European regimental lines.

CHAPTER VII.

THE MANAGEMENT OF ENTERIC WARDS.

THOUGH it is a generally recognised fact, that it is safe to treat cases of enteric fever in ordinary wards, so far as the other patients are concerned, if proper sanitary precautions are taken,—and, as a rule, mild cases do fairly well under such circumstances,—yet it is undoubtedly advisable to have special wards and special arrangements in every hospital for the treatment of enteric fever. There is, moreover, the great risk of men convalescing from enteric fever, obtaining prohibited articles of food when in ordinary wards, as, when recovering, the appetite is frequently ravenous, and in spite of all injunctions to the contrary, patients will eat forbidden articles, such as solid meat, potatoes, &c., the result being too frequently a severe relapse. For this reason, then, all cases of enteric fever ought, if possible, to be treated in separate wards, and, where practicable, in detached buildings, quite isolated from the main blocks. Given a detached building, as for example the enteric ward at Lucknow, which was formerly a female hospital, there are many points which require attention, the neglect of any of which may prove injurious to the sick. In the first place, the sanitary arrangements must be thoroughly well organised, and all the excreta should be immediately disinfected and removed. The most perfect cleanliness should be observed in every particular, all soiled bedding and personal linen being at once removed, and when fouled by discharges, should be disinfected by being dipped in a solution of carbolic acid. It is also advisable to sprinkle a small quantity of carbolic powder under each bed daily, which can be swept up when the ward is being cleared. The light in the ward should be as subdued as is compatible with cheerfulness, and for this purpose the walls, and the glass of the clerestory windows, should be colored a pale green. The temperature of the ward should be kept as uniform as possible: never, in the cold weather, being allowed to fall below 62° to 65°. If the ward is allowed to get cold, the liability of patients suffering from enteric fever, to contract pneumonia or acute bronchitis, is much increased. In cold climates a great proportion of the deaths from enteric fever in winter is caused by pulmonary complications, and I found it necessary, in the fever wards in Dublin, to have a "slow combustion stove" placed in the centre of the room, which enabled the temperature to be regulated as desired. In this country judicious arrangements for closing the doors will generally suffice; but in very cold weather small *charcoal stoves* would be found beneficial. The temperature of the wards in the hot season is a matter of far greater difficulty, as no amount of care will prevent buildings getting super-heated during the hot winds. In the enteric wards at Lucknow the most methodical system is in force. The doors are opened late in the evening, when the air is cool, and closed early in the morning before the hot winds set in. All the doors on the wind-ward side are provided with *tatties*, which are kept constantly watered, and a large thermantidote, at either end of the building, pumps in cool air during the entire 24 hours. With all these precautions it is difficult to keep the wards below 85°, but this is generally the maximum, even when other parts of the hospital are over 90°. Ventilation is provided for by keeping some of the clerestory windows open, and the constant influx of fresh air, through the thermantidotes and tatties, keeps the wards fresh and wholesome.

The presence of mosquitos and flies frequently cause much annoyance to the sick, but if constant attention is paid to this subject, all insects can, practically, be abolished. Dr. Bonavia's suggestions regarding mosquitos are most effectual, *viz.*, to raise all chicks and open all doors after dusk, when the air outside is cool, and at the same time keep the inside of the house in perfect darkness. If this plan be adopted, it will be found that all or nearly all the mosquitos will go outside to feed, and after an hour or so, while the place is still dark, all chicks should be lowered *before* the lamps are lit. The presence of flies gives even more trouble to the sick, as, during daylight, they worry the patients by crawling over them and getting into their food, &c. The use of ordinary poles and nets is difficult, as the nets have to be frequently raised to give the patient food or drink, or to enable the nurses to attend to him. With a little determination, however, flies can be abolished completely, and in a well-managed fever ward, they should rarely be seen. The first step, if they are numerous, is to drive them out wholesale, which is easily effected in the early morning by raising every chick in the building and opening all the doors; a line of men, orderlies and ward servants, should be formed at one end of the building, and with towels should drive all the flies before them. As the line advances, other men should lower the chicks, till the far end of the building or ward is reached. If this is done, quietly and systematically, it is surprising how few flies will be left behind. To kill those remaining there are two methods—one by poisoning them, the other by means of fly-flappers. The simplest method of killing flies by poison is to use a cold infusion of quassia, in the following way:—Plates should be covered with pieces of broken bricks, leaving a space in the centre, in which a few quassia chips are placed; on these sufficient water is poured to infuse the quassia, leaving the upper surface of the bits of brick uncovered. A little sugar should then be sprinkled on the plates to attract the flies. When the infusion becomes exhausted, or the plates dirty, the quassia can be renewed. The pieces of brick saturated with the infusion should, however, be preserved, and can be used over and over again, thus economising the quassia. A few fly-flappers, provided for the use of the attendants, will soon account for any that are left, as those not killed by the quassia, are stupefied and torpid. It is not too much to say that a ward, managed in the above manner, can be kept almost absolutely free from all flying insects. Sparrows also cause much annoyance to patients by their noisy habits, and also in consequence of their "droppings" falling on the beds, food, &c. I have found the best means of getting rid of these pests in the use of phosphoric paste spread on bread with a little butter. The sparrows when feeling the effects of the poison, as a rule, go outside in search of water, and thus do not die in the roof where they might become offensive. An air-gun, carefully used, is another capital plan of getting rid of birds.

To protect helpless patients from flies and mosquitos, I have devised a very simple form of frame, something like a small buggy-hood. This is bolted on to the head of the bed, and can be lowered or raised in an instant. The mosquito netting over it is weighted along the free margin with shots, and thus takes the shape of the patient as he lies in bed and covers him down to the hips. This simple invention has been in use in the Lucknow hospital for months, and answers the purpose for which it was devised in an excellent manner. Cases of phthisis, or other disease, in the treatment of which flies cause much annoyance, are entirely relieved from all trouble by means of these fly-guards.

The beds should be as comfortable as possible,—not an easy matter under the present regulations, which provide nothing but coir mattresses, no matter whether the patient be prostrated by fever or suffering from the most trivial affection. All hospitals ought to have a proportionate supply of hair mattresses and feather pillows, or, better again, wire mattresses, for the treatment of really severe cases; while men suffering from ailments, the result of their own vice or imprudence, might very well use their barrack bedding, or cheap bedding of a similar kind. By such an arrangement the cost of really good bedding for severe cases could be met without any extra expense to Government. It is probable that wire-woven mattresses will soon, however, be introduced in Indian hospitals. In the absence of hair mattresses, a couple of cases filled with freshly-teased coir placed one over the other, makes a fairly good substitute. A folded blanket should always be placed between the under-sheet and the mattress. This prevents the patient getting a chill, and also protects the mattress from the effects of perspiration. It is always necessary to have a spare bed in the ward, on to which weakly patients should be shifted when their own beds are being made.

Feather pillows can also be provided for hospitals, free of cost, if the small feathers from the diet-fowls be collected. It is necessary, however, to "stove" them up to a temperature of about 212°, to kill lice or other insects. This is easily done where there is a disinfecting apparatus available, but if there is not one, by placing the feathers in a large boiler, and putting that over another in which water is boiled, the temperature of the feathers can be raised to the desired degree without injuring them. The inside of the tickin should be rubbed with bees'-wax, to prevent the smaller feathers working through, and the pillows are then ready for use. The feathers of fifty fowls provide one good pillow, and the cost is almost *nil*.

As nurses are as yet only provided for two military hospitals in India, and as in severe cases we have to trust entirely to regimental orderlies, it is necessary that the most minute instructions be given regarding the attendance on bed-ridden patients: changing the sheets, the use of the bed-pan, &c., should be practically taught, as frequently much injury is unwittingly inflicted on weakly patients through want of care in, or rather from want of knowledge of, such duties. A patient prostrated by enteric fever and allowed to get up to go to stool, or, as I have seen done myself, placed sitting in a chair while his bed is being made, may lose his life as a result of such treatment. Yet these accidents must constantly happen till an efficient system of nursing is instituted. An ice-box should be part of the furniture of the enteric ward, as in it can be kept the patient's milk, drinks, effervescing waters, &c., cool and sweet. If the ice has to be frequently brought over from the main hospital much waste results, or, if kept in blankets, it cannot be utilised properly. There should always be a reserve of ice in enteric wards in the event of cases of hyperpyrexia requiring "packing."

All punkahs should be pulled with as little noise as possible, and for this purpose leather thong ropes are the most suitable.

A small kerosine stove, for heating the food at night, is very useful, as otherwise the sick are almost certain to receive nothing but cold broth after the kitchen fires are put out.

In hot weather it is often difficult to prevent milk turning sour. A slight scalding in a closed vessel, and the addition of 10 grains of bicarbonate of soda to each pint, will keep it sweet for many hours, especially if, when cool, it is placed in the ice-box.

The orderlies on duty in enteric wards should, if procurable, be steady men, who have themselves passed through an attack. They will thus be practically safe from infection, and having suffered from the disease themselves, are more likely to understand the necessity for all orders being implicitly attended to. The orderlies should always wear slippers in the wards, and should be instructed to take regular exercise in their turn morning and evening.

The hospital (native) servants should be placed on a roster in such a way as to ensure the constant presence of a sufficient number of ward servants, sweepers, and water-carriers, night and day. Nothing upsets patients more than being kept waiting when requiring to be attended to, and, if the orderlies have to search for and call the native attendants, they lose their tempers, and are apt to abuse or strike them, thus upsetting the whole discipline of the wards, and interfering with the quiet, orderly routine, so necessary for the well-being of the sick.

The preparation of beef-tea and chicken broth for enteric cases should be done in a systematic manner, and should not be carried on with the cooking for the ordinary wards. "Digestors" of the English pattern, with covers that fit closely by means of iron ridges and stops, and provided with a safety-valve to prevent accidents, can be purchased for a trifling sum at Behrens and Sons, Calcutta, and will well repay their cost. In these "digestors" the very best broth can be prepared, with the minimum of skill or trouble. All fat should be removed from the meat or chicken before it is put in the digestor, and all grease carefully skimmed off when the broth is cooked.

There is always much difficulty found in heating food at night, and for this purpose a small kerosine stove is used in the Lucknow hospital. The cost is a trifle, and the oil can be drawn as for a lamp from the Commissariat, as it answers as a night-light in addition to being a stove.

It is perhaps hardly necessary to say that the most extreme quiet should be insisted on, and no one, officer or man, be permitted to visit the enteric wards without the special knowledge and sanction of the Medical Officer in charge. Written orders to this effect should be given to the Non-Commissioned Officer in charge of the orderlies, and the Regimental Authorities should be asked to support the Medical Officers in this arrangement. If this be not done, comrades will endeavour to visit sick friends, and even officers, to my knowledge, will bring accounts to be signed by patients, quite forgetting, or being ignorant of the fact of, how necessary extreme quiet is for enteric patients.

CHAPTER VIII.

THE TREATMENT OF ENTERIC FEVER.

THE treatment of enteric fever should be considered under three heads, *viz.* :—

I.—Nursing.

II.—Dieting.

III.—Medical treatment.

Taking nursing as the most important item in the treatment of enteric fever, the first thing that strikes the observer is, how lamentably deficient good nursing is in Indian military hospitals. Theoretically, the men of the Army Hospital Native Corps are the only nurses acknowledged officially in India—(we can hardly yet recognise the presence of the new lady nurses, as they are, up to the present, at work in only one station in Bengal and one in Madras)—though comrades are permitted to be employed as orderlies over the sick, on application to the Military Authorities by the Medical Officer in charge.

I may here repeat what I have written on a former occasion, *viz*, that the men of the Army Hospital Native Corps never were, and never can be, nurses for sick soldiers in any sense of the term The water-carriers will bring water, the sweepers will clean out the wards, the cooks will prepare the food, but as regards nursing, in a case of enteric fever especially, the native attendants are utterly unsuited to the work. The want of knowledge of their respective languages alone, places a bar between the sick soldier and native attendants, and, personally, I would never dream of entrusting the case of really sick Europeans, more especially cases of enteric fever, to natives of India. Who then have we to look to in the hour of need for attendance on the sick? The answer must be, untrained men from the ranks; and until an adequate supply of trained nurses is available, we must only be content to do the best we can with the materials at hand. The following remarks by Murchison on the necessity of good nurses in cases of fever are worthy of note, as showing the opinion of one of the greatest authorities on this point. He says:—"One of the first things to be done is to secure the services of an experienced and judicious nurse, strong enough to lift the patient when necessary. Much of the success of any treatment will depend on good nursing. The moving or raising the patient in bed and changing his linen, are duties performed very differently by a nurse and an inexperienced person; and even the delirious patient appreciates the tenderness and skill of those who minister to his wants." Can Medical Officers in India count on such assistance as this? In the future perhaps we may, but at present, at all events, the answer must be a sorrowful negative. Failing skilled nursing, arrangements must be made to train orderlies to carry on the duties as efficiently as possible I may here remark that, in my opinion, the newly-arrived sisters might most usefully be employed in training orderlies for nursing duties, and for this purpose might be sent on tour during the cold season, visiting the principal stations in the Presidency, and imparting instruction for, say, two months at a time. Next to having trained female nurses, a number of orderlies who have been specially selected, and have undergone a course of practical instruction, would be very valuable. No doubt in years to come, Medical Officers will be able to count on the assistance of trained female nurses whenever necessary, but till that day arrives, we should be provided with substitutes as efficient as possible. It is now an army regulation that two men per company, troop and battery, are to be trained to "first aid to the wounded," and stretcher drill, and it would be a simple matter to go a step further, and train them to nursing duties. These men ought, when qualified, to wear a distinctive badge, say a small Geneva Cross, on the left arm, and be at all times available for nursing sick comrades. The weak point in the present system is, the Medical Officer can never *command* the presence of even the men he has trained himself. Musketry classes, courses of drill, &c., all interfere, and he has frequently to take men not at all well suited to the duties and make the best of them. It would be a simple matter to have, say, one Non-Commissioned Officer and two men per company, trained as nurses, and these men should invariably be available when required. The question of some small remuneration should also be considered, as now the only reward a man receives for performing a most irksome and disagreeable duty, is light refreshment in the early morning.

While on this subject I would wish to place on record my high appreciation of the manner in which regimental orderlies attend on the sick. I have seen the most unselfish, untiring, and tender care bestowed by these rough-handed men on their helpless comrades. Few people who have not had close opportunities of observing the work to be done in an enteric fever ward, can have any idea of the labour entailed by such duties, and when they have to be carried out by those unaccustomed to the work, it is far more irksome. Peevish, helpless patients—some delirious, others requiring to be held down in bed—food to be given, as directed, at short intervals night and day—sanitary duties to be attended to; cold packs or baths to be given when required ; in fact, the thousand-and-one necessities of the sick, multiplied by the number of patients under treatment—render the life of an orderly in an enteric ward one continuous round of anxious care and labour. How little does the army generally think of the anxiety and work entailed on all concerned by such attendance? "It is their duty and they are paid for it," is the common feeling. True, but what pay can reward men for loss of rest night after night, and the performance of duties to which they are unaccustomed, and to which they have not been trained. Take, for instance, the outbreak at Lucknow in 1886—105 men and several officers, women and children were attacked by enteric fever, some 120 cases in all, with but fifteen deaths. At one time there were fifty cases under treatment, many of them most severe, at the hottest time of the year. Had such an outbreak taken place in London, or any large town at home, extra trained nurses would have been available, and the resources of the city been at the disposal of the Medical Authorities. At Lucknow no trained nurses of any kind were available, and, as the cases increased, we had no other resource than to call on the Military Authorities for extra orderlies, and with this untrained assistance manage as well as we could. The labour entailed on Medical Officers and subordinates was immense ; and if one fact only be considered, *viz.*, the taking of the temperatures of the sick twice daily, each operation, with the thermometers supplied by Government, lasting five minutes, some slight idea may be formed of the work that was done. A simple calculation will show that it took over eight hours daily to record the temperatures of these fifty cases morning and evening, and this was but a small portion of the daily routine of clerical duties. Had there been a staff of trained nurses, with a number of instructed orderlies to assist, the labour of all would have been much diminished, the sick would necessarily have been more skilfully nursed, and possibly the death-rate would have been lower. The great difficulty in dealing with a Government, is to make it see the value of an *indirect saving*. Any one can see the cost of a proper system of nursing. The wages, rations, clothes, pensions, &c, are all noted down, but few can be made to see the indirect value of the saving of life, (to put the matter on its lowest terms), entailed by an efficient nursing system. A British soldier is, I believe, valued at some Rs. 2,000 in this country, so that saving the life of only one man would represent the cost of a good deal of skilled attendance, to say nothing regarding the moral obligation entailed on the State, to provide the soldiers in this country with the best treatment procurable when he is smitten with sickness. A commencement has indeed been made, and soon we may hope to see such a nursing organisation in this country as will enable Medical Officers to treat their cases of enteric fever with the same confidence as regards the carrying out of their orders, as they could in a London fever hospital. The sooner that day comes the better will it be for the young officer and soldier struck down by fever, or any other prostrating disease.

It would be out of place to enter on the actual nursing duties connected with the treatment of enteric fever, as these are well known to all Medical Officers. Suffice it to say, that when any number of orderlies are employed, it is advisable to have them placed under the orders of a steady Non-Commissioned Officer, to whom written instructions should be given on all subjects connected with the management of the sick. It is also necessary to lay down rules to ensure that the orderlies be enabled to take exercise at regulated hours, as long confinement in the wards must sooner or later be prejudicial to their health. As regards the liability of orderlies to contract enteric fever from attendance on the sick, I consider they enjoy an almost perfect immunity. I can only recall two instances in two and a half years. In one case an orderly in attendance on an officer contracted the disease, but in this instance he resided in the house in which the officers sickened, and in this same house a third person was afterwards attacked, which certainly appeared to indicate a local cause. In the second case, the man was a young soldier, and was therefore just as liable to the disease as any of the other men in the garrison ; in fact, the evidence of infection from the sick is practically *nil.*

Admitting, however, the immunity from disease that nurses, so far as my experience goes, enjoy when attending on cases of enteric fever, it will be well to attend to a few practical points.

First, very young or newly-arrived men should never, if possible, be employed ; but instead, when available, seasoned, trained men, who have themselves passed through an attack ; *second*, the orderlies should never be allowed to sleep in the wards, or, when off duty, be exposed to the influence of their atmosphere. They should also be compelled to take regular exercise, and to be as much as possible in the open air. It is advisable to have tents pitched for the orderlies to live and sleep in, when detached wards cannot be given up for their use ; and *third*, rigid sanitary precautions should be laid down and adhered to, as regards the immediate disinfection and removal of the excreta of the patients.

CHAPTER IX.

DIETING OF ENTERIC CASES.

THIS subject may be considered under three heads, *viz.* :—

I.—The diet of acute cases.
II.—Convalescing cases.
III.—Convalescent cases.

To again quote Murchison : "The food ought to be both nutritious and digestible, and may consist of such articles as the following :—Milk, eggs, beef-tea, veal or chicken broth, to which may be added vermicelli or arrowroot, meat-essences, meat-jellies, custard, bread and milk, arrowroot, sago, tea or coffee freely diluted with milk," &c. "In all fevers a large quantity of farinaceous food will probably be undigested, owing to the diminution of the salivary and pancreatic secretions. Of all these forms of nourishment I agree with Dr. W. T. Gardiner in thinking that milk is the best."

Parkes has shown that there are objections to a purely nitrogenous diet in fevers, as it is doubtful if the disintegrating nitrogenous tissues can be fed, in which case albuminous food must be disposed of by the already over-tasked glandular organs.

Murchison also states that he has "not, as a rule, found milk disagree with the acid treatment ; milk is coagulated by the acid of the healthy stomach." This remark is worthy of note, as some practitioners hold it to be wrong to prescribe a milk diet with acids : for instance, with lime-juice in cases of scorbutic dysentery, when, if they had only considered for a moment, they would have remembered that the milk is curdled by the gastric acids as soon as it reaches the stomach; yet, even by the youngest children, it is in this state easily digested.

In private practice, where there is, as a rule, but one patient to attend to, and skilled nursing is available, much greater latitude is possible in the dieting of cases of enteric fever than could be allowed in a military hospital, with, generally, several cases to attend to, and an almost entire absence of nursing, other than that improvised from such untrained assistants as may be available. Cooking, also, in military hospitals, is more difficult; at all events, "sick cooking," by which I mean all the delicacies a trained nurse, assisted by a skilled cook, can improvise from such materials as may be available. In treating a number of severe cases of enteric fever in an Indian military hospital, it is necessary to lay down a routine; in fact, to dogmatise in matters of diet, as it is practically impossible, without trained nurses, to vary the diet in every case in the manner one would perhaps desire, and which would be possible under other circumstances. Indeed, it is hardly necessary to make much distinction in ordinary cases of enteric fever running a favorable course; but in such instances as demand a particular diet, special arrangements must be made. It will be found that in the acuter stages of enteric fever, a diet composed of milk, chicken broth, and beef-tea, will, as a rule, be found sufficient, and as the fever progresses, other articles can be added. In the acute stage of the disease, which may roughly be looked on as the period during which the fever is constant, in most cases milk and chicken broth, varied perhaps with beef-tea, will be sufficient; but when the fever commences to intermit, and the temperature falls to normal in the morning, other articles may be gradually added. The first and most important point is to secure a supply of good milk from well-fed cows.

This subject has been alluded to before, and the precautions necessary to ensure a pure supply, detailed; but it will not be sufficient to procure unadulterated cows' milk, if the cows themselves are in bad condition or improperly fed. This is a subject that has, as yet, had little attention given to it in India; and, till hospitals (and indeed barracks) are supplied from cows carefully fed and isolated from the rest of the bazar cattle, the milk-supply will remain a matter of suspicion, or worse. The simplest tests are, of course, appearance, taste, smell, and specific gravity; and here it is well to remark that many people are misled by the specific gravity of milk, and are apt to pronounce milk having a low specific gravity, bad, and *vice versâ.* The safest test of the goodness of milk is the amount of cream it contains, and that is easily ascertained by filling a graduated test-tube with the milk and allowing it to stand till all the cream has separated. Sir Charles Cameron, of Dublin, lays down that 9 per cent is about the lowest amount of cream that well-fed, healthy cows should yield. In the dry season at Naini-Tal, when the pasturage was good, and the cows only gave a small quantity each, I have seen the cream as high as 18 per cent; while a few weeks afterwards, when the rains were on and the same cows were grazed on the new, green, watery grass, the cream fell as low as 6 per cent. Whenever the milk looks and tastes poor, and at the same time gives a high specific gravity, it is very probable that the cream has been removed by churning, and that the supply is really skimmed milk. Mrs. James, of Almora, has recently published a book on "Cows and their feeding," which *gives full instructions regarding a pure milk-supply*, and her remarks are well worthy of adoption.

Assuming the milk-supply for enteric cases to be as good as can be procured, it will be advisable to consider the quantity of milk that should be given in each case; and here I may remark there is generally a tendency to over-feed cases of enteric fever, at all events during the first two or three weeks. In very hot weather, fever cases will naturally consume a much larger quantity of fluid than in the more temperate, or cold months. It is often extraordinary, too, the amount of fluid ordered for cases of enteric fever, in some instances, when counted up, amounting to a quantity that could not possibly be consumed. For instance, a patient is put on chicken diet, and the chicken is ordered to be made into broth. In addition to the fluid allowed on this diet, extra chicken broth, beef-tea, milk, soda-water, lime-water, wine or brandy, &c., are entered, which, when added together, amount to a number of pints that could not possibly be consumed, so that not only is the patient over-fed, but much of the surplus is wasted. Taking an average case, and placing the patient on chicken diet, making the chicken into a pint of broth, the addition of two pints of milk, diluted with one-third of lime-water, and a pint of extra beef-tea or chicken broth, is about as much as a man can digest during the twenty-four hours. In very hot weather, a little iced soda-water may be given to quench thirst, and when stimulants are given, they may be diluted with iced water or soda-water. Milk should invariably be diluted, and it should be a standing rule, in all enteric wards, to add ¼th to ⅓rd of lime-water to each pint. This renders it more digestible and less liable to form masses of curd in the intestines.

The question of peptonising milk and other food for enteric cases is a most important one, but here again the want of trained nurses steps in. It can easily be understood what difficulties lie in the path of the Medical Officer who has charge of a fever ward, when he cannot rely on his nurses implicitly. Peptonising milk is an easy operation in itself, yet it requires a certain amount of skilled handling, and if imperfectly, or overdone, the effect is, to a great extent, lost. In ordinary cases, therefore, where the milk is digested, and no unfavorable symptoms are present, I rather advocate simply diluting the milk with lime-water; but where there is evidence of the milk disagreeing, it is advisable to peptonise it. This operation cannot be entrusted to native cooks, and it will (in the absence of a trained nurse) be necessary for the Medical Officer to teach the medical subordinate in charge of the ward how it should be done, and hold him responsible his directions are carried out.

While on the subject of milk, it will be well to consider the subject of preserved, or condensed milk, as, though these preparations are seldom required in a station, they are frequently the only milk-supply available on boardship, or in the field. That usually supplied hitherto for active service has been what is known as "Swiss milk," which is milk preserved with some 30 per cent of sugar added. The intense sweetness of this preparation renders it most unpalatable to the sick, and after a few days it is almost impossible to persuade patients to drink it. In the Soudan I found that, unless iced, it was disliked by most of the fever and dysentery cases, and as fresh milk was not to be had, the feeding of the sick became a most difficult matter. This difficulty can be entirely obviated by the use of unsweetened milk, which is most palatable, and when made up with water, can hardly be detected from new milk. Of the unsweetened milk preparations, that called "Loefund's cream-milk," sold by Loefund & Co, Fenchurch Street, London, is about the best, as none of the cream is abstracted, it contains 10·85 of milk fat, and is condensed without cane-sugar or antiseptics, and will, it is stated, keep in any climate. It would be well if a trial of this preparation were made in this country; and if it answers, a large proportion of it should be taken on field service. The ordinary Swiss milk answers very well to put in tea, make puddings, &c., but when cases of enteric fever and dysentery have to be fed on milk diet, an unsweetened preparation should invariably be used. This should be mixed in the proportions laid down, and then lime-water should be added before being given to the patient.

Lime-water being bulky is not easily carried on service, but its manufacture is so easy that it can be made in any quantity wherever required. The simplest plan is to wash a nodule of kunkur (nodulated lime-stone) free of earth, then burn it well in a charcoal fire, and place it in a *gurrah* of water. As the water takes up only 11 grains of lime per pint, there is no difficulty about its strength, and it is only necessary to add water, stir up and let it settle, to keep the supply going as long as there is any lime undissolved.

Chicken broth and beef-tea should be made in "digestors," and be carefully skimmed till all fatty particles are removed, and should then be seasoned to taste. When extract of beef is used, the burnt taste, so much complained of by some patients, may be a good deal removed by adding a small quantity of sugar and a little sherry, before adding salt.

When the patient commences to convalesce, soft boiled eggs, very light puddings, ground rice boiled in milk, and other easily digested articles of that nature may be added to the milk and broth diet, but solid food in the shape of meat in any form should be withheld till the patient has been free from fever for several consecutive evenings.

When convalescence seems fairly established, it is well to commence with a small quantity of the white meat of a chicken, cooked with a little milk, and then finely mashed in a mortar, and spread on thin slices of bread and butter. In the same way a little fish may be given, and if this is digested, a tender " squab " pigeon, cut open and quickly grilled. This may be followed by a chicken spatch-cock a few days later; quail, snipe, &c, when in season and procurable, will also be allowable. By slow degrees the patient should be brought back to a meat diet: at first a tender chop quickly done on the gridiron, and so on, to ordinary roast and boiled. Potatoes ought to be withheld for a considerable time, as also should fruit having seeds or stones likely to be swallowed. I saw in one case a patient suffer from a severe relapse in consequence of his having eaten some grapes, the seeds of which had, no doubt, irritated the unhealed ulcers in the small intestines.

CHAPTER X.

CURATIVE TREATMENT.

MURCHISON lays down "there is no specific for enteric fever," and while "much mischief may be done by the *nimia diligentia medici*," by depletion on the one hand, or by over stimulation on the other, it must not be thought that the best treatment is one of mere expectancy. "Although we cannot *cure* the disease, we must *treat* it." "If we can keep the patient alive a certain time, the disorder will pass away, and hence it is always important to determine the precise duration of the attack and to study the tendencies to death, by obviating which the patient may be enabled to tide over the critical period."

This axiom is just as applicable to India as to England, with the one additional remark, that the tendency to relapse is more frequent in the tropics than at home. The great bulk of cases in a temperate climate may be regarded as safe from relapse under ordinary circumstances, *i. e*, with reasonable precautions as to diet, exercise, &c., if once the evening temperature has become normal and remained so for a few days. In India, I consider no case perfectly safe till all symptoms of fever have been absent for at least three weeks, and even after that period I have seen severe relapses.

I can recall the case of an officer, whom I treated in the military hospital, Naini-Tal, whose temperature never once was normal for 65 days. This young man had three distinct and severe relapses, and his temperature was over 105° on the 50th day of the disease. In the end he made a good recovery, and rejoined his regiment. In another instance a man was seventy days in hospital suffering from enteric and the subsequent debility. He was sent to the hills with convalescents, got a relapse on the march up, developed fresh typical enteric symptoms, and finally died. The *post mortem* examination revealed over thirty unhealed ulcers in the small intestines.

The question then to consider is, how long does this dangerous period last? To this I reply, a patient convalescing from enteric fever in India should be kept under observation, and most strictly dieted, for, at least, three weeks after all fever has subsided, and even after that period has elapsed, he should be warned to be most careful as to his diet, and to avoid exercise of a fatiguing nature.

Now, as regards the actual medical treatment to be adopted in cases of enteric fever.

Murchison describes treatment under the following heads:—

I.—Neutralise the poison and improve the state of the blood.

II.—Promote elimination, not merely of the fever poison, but of the products of metamorphosis.

III.—Reduce the temperature and the frequency of the action of the heart.

IV.—Sustain the vital powers by appropriate food and stimulants.

V.—Relieve distressing symptoms.

VI.—Obviate and counteract complications.

VII.—Treatment during convalescence.

A reference to Murchison's work will give his opinion on these various heads, but, as regards the first, I may say

I do not believe there is any method by which we can "neutralise the poison," or, in other words, cut short the attack. I have known arsenic recommended for the above purpose, but when tried it failed utterly. Quinine, again, is largely used by some, but, in my opinion, in the early stages of the disease, it does much more harm than good. The only drug that I have found of any value in the early stages is chlorate of potash, and it is used more as a drink than as a medicine, cleaning the mouth, and acting on the intestinal tract as an oxydiser, also to some extent perhaps as an eliminant. I generally order ʒi of chlorate of potash in a pint of water, and direct an ounce of this mixture to be added to the patient's milk, chicken broth, &c., frequently during the day.

Murchison thinks highly of free chlorine which he produces by mixing grains vi of chlorate of potash with Mxxxvii of strong hydrochloric acid, adding ℥xi of water, and subsequently acid hydrochloric dil. ʒiv, and spirits of chloroform ℥ss; one or two tablespoonfuls as a dose.

Coming next to the elimination of the fever poison, Murchison considers it under the following heads, *viz.* :—

I.—Fresh air.
II.—Diluents.
III.—Diuretics.
IV.—Salines.
V.—Diaphoretics.
VI.—Emetics.
VII.—Laxatives.

Undoubtedly the chief feature in the treatment of enteric cases is to place the patient in thoroughly good sanitary surroundings, "fresh air, and plenty of it." This subject has already been considered under the head of management of enteric wards, so it need not be further alluded to here, except to remark that the chief difficulty experienced in this country is, naturally, the temperature of the wards. There is never any difficulty in keeping wards up to 60°, but the difficulty lies in keeping the temperature down during the hot months, not to 60° or 70°, but even to 80°, and sometimes to 90°, and this difficulty is one of the main causes of mortality during the hot months. In Dublin, the great difficulty I experienced in the infectious hospital there, was to keep the temperature of the wards in the winter time anywhere near 60°, and I have seen water frozen on the stairs, with the temperature inside the wards, notwithstanding blazing fires all night, at 43°. As a result, pneumonia was frequent and fatal, and not till I got a "slow combustion" stove put in the centre of the enteric ward, could I keep the temperature anywhere near 60° in the winter. On active service, in cold climates, this must be a great cause of mortality, and huts, intended for the treament of enteric cases, should always be furnished with small stoves to enable the air to be kept up to the required warmth. The same may be said regarding the treatment of bronchitis and pneumonia, where, undoubtedly, one of the most important matters is an equable temperature ranging between 60° and 65°.

Diluents are, of course, indicated, especially when the weather is very hot and the skin acts freely. The use of Benton's diet charts is essential, as laying down rules for the attendants regarding the administration of food and drinks. It is as well to give some nourishment when giving a drink, hence milk diluted with lime-water, with some of the chlorate of potash mixture and well iced, acts in the double capacity of quenching thirst and giving nutriment. Small pieces of ice to suck, sips of barley water, &c., are all advisable ; but one rule should be invariably observed : never to give a quantity of drink at a time, nor to allow the patient to distend his stomach.

Diuretics. When the kidneys do not act freely, and the urine is very high-colored and scanty, diuretics are indicated, for which purpose Murchison recommends 5 grains of nitrate of potash, 15 minims of nitrous æther, with a few drops of digitalis. It must always be remembered that though the urine is scanty, there is a large flow of fluids from the blood if diarrhœa is present : in hot climates the action of the skin is intensified by the heat, so that fluids are indicated in sufficient quantities to allow for these drains, and at the same time permit of the elimination of urea by the kidneys in a diluted form.

Salines. Murchison advises the addition of considerable quantities of salt to the beef-tea, to allow for the deprivation of salt in other articles of food. In India I am inclined to think salt in excess would be likely to increase the thirst, and have seen no ill effects from its having been reduced in the diet.

Diaphoretics are occasonally indicated in the early stages of enteric fever, when the skin is hot and pungent, but, as a rule, they are not advisable.

Emetics given in the early stage are sometimes useful relieving the headache, getting rid of accumulations of bile, and apparently, in some instances, cutting short the disease.

Murchison remarks :—" They should never be given after the 12th day, for when the peritoneum is laid bare by the intestinal ulcers, the act of vomiting may induce perforation."

Laxatives. The usual treatment of enteric fever in temperate climates is to avoid laxatives, and the late Dr. Todd laid down the following *dictum:*—"Restrain diarrhœa and hæmorrhage in typhoid fever, and when you have fairly locked up the bowels, keep them so. Patients will go for four or six days, or even longer, without suffering inconvenience from this state of constipation." Other eminent authorities recommend laxatives, but Murchison says, "my experience in many thousand cases has led me to the conclusion that the cerebral symptoms of enteric fever are not due to the absorption of putrid substances from the intestines, and that diarrhœa is not a process of elimination to be encouraged." In enteric fever, as seen in India, diarrhœa is not at all the rule. Indeed, a very large proportion of the cases suffer from constipation throughout the course of the disease, and I have frequently observed the temperature to rise when the bowels are allowed to remain unmoved for two or three days. I have found that the administration of one to two drachms of castor oil, guarded by five drops of tincture of opium, with a couple of drops of oil of peppermint, in two ounces of hot milk, gives much relief, causing gentle evacuations, and relieving headache. In no case have I ever seen the administration of small doses of castor oil do harm, and when the bowels are confined the above combination is most valuable. Laxative enema are also useful.

The administration of drastic purgatives should be absolutely forbidden, especially in the latter stages of the disease, when the ulceration has rendered perforation of the peritoneal coat of the intestines possible, as the result of excited peristalsis.

The next, and one of the most important points to be regarded, is the reduction of the temperature of the body, and this may be considered under two heads :—I, the mechanical reduction of the body temperature by external cold ; and II, by the administration of anti-pyretic medicines.

The cold-bath in high temperature of the human body has been in use for years, and has no doubt been employed with great advantage in innumerable cases. The great objections to the system are the mechanical difficulties, and the necessity for the operation being performed under trained and skilled nurses. It also entails much labour on the attendants, wets the floor of the ward, causes noise and disturbance to other patients, and when cases are numerous, as for instance in the Lucknow Hospital in 1886, the difficulties become insuperable. The "wet pack," on the system suggested by Dr. Finney of Dublin, is far more simple, and, in my opinion, quite as efficacious. Dr. Finney prepares the patient by stripping him naked, and placing him on a bed protected by a waterproof sheet, and covered with a blanket. Then he takes a number of towels wrung out of ice water—one being wrapped round each limb, one round the trunk, and another round the head. The body is then covered with a light wet sheet, and as the towels get warm they are replaced, one by one, by others freshly taken out of the iced water. By these means the body temperature can be rapidly lowered, and when reduced to the desired degree, a light blanket is thrown over the patient after the towels have been removed ; when rubbed dry he should be moved to another bed. By this system several patients can be rapidly and efficiently attended to at once with a minimum of labour, and without noise or disturbance in the ward.

Within the past few years several antipyretic medicines have been introduced, though for many years quinine has been known to act in this manner. So far back as

1870-71, I conducted experiments on the action of quinine in lowering the temperature of the body, and published the results in the *Indian Medical Gazette.* Subsequently the action of quinine in reducing the temperature of the body in sunstroke was well established, and it became a recognised method of treatment in India. In consequence, however, of some cases of tetanus having followed its use, this system of treatment was officially forbidden in the Bengal Presidency in the year 1879, since which time it has not been allowed. At the meeting of the Medical Congress in America last year (1887), Brigade-Surgeon J. Anderson, *C. I. E.*, read a paper advocating this treatment for sun-stroke ; but in the face of the official prohibition it cannot be put in force in this (Bengal) Presidency. The introduction of the new drugs, antipyrin and antifebrin have quite superseded the use of quinine as an antipyretic, and in most cases it is seldom necessary even to use the cold-bath, or cold pack, for the purpose of lowering the body heat. In 1886, in the epidemic of enteric fever at Lucknow, antipyrin was largely used, and was found so valuable that a special report on its action was submitted by me to the Surgeon-General, and by him it was circulated among all Medical Officers. The use of this drug was then officially sanctioned, and it is now recognised in the list of medicines procurable on requisition. The action of antipyrin in reducing the temperature is, in most cases, well marked, and given in doses of grains 20, at intervals of an hour, rapidly brings the body heat down. It is not advisable to give it when the patient is in a state of prostration, or the heart's action is weak, or towards the termination of a case when the physical energies are lowered by a prolonged illness ; but so long as the patient is in a fairly sthenic condition, I have never seen any ill results follow its use. I generally order it in doses of grains 20 at intervals of an hour, the temperature being carefully taken before the subsequent doses are administered. It is well to give an ounce of brandy with the second and following doses, especially if the first causes any lowering of the vital powers, as indicated by the pulse and general condition. On the whole, antipyrin is a very valuable drug, and in few cases is the external application of cold water necessary, when it is fairly and carefully used. It is advisable, however, to watch the condition of the patient, and if there is a tendency to collapse, or cyanosis, its use should be interdicted, at all events without careful precautions, and the administration of stimulants with it. The introduction of antifebrin has placed in our hands an even more powerful agent than antipyrin; and while its effects are more satisfactory, the dose (grains 5) is much smaller, and the cost is, I believe, less. The use of antifebrin also seems safer than that of antipyrin, as the depressing effects of the latter drug are absent, and the lowering of the temperature of the body seems quite as efficiently effected. So far also as I have been able to judge, it effects are more permanent. In doses of 5 grains every hour, whenever the temperature rises above 103°, the heat of the body is rapidly lowered, and frequently, when so lowered, is not seen to rise again to the height it was before its administration. I have not as yet had so many opportunities of testing the antipyretic powers of antifebrin as I have had of antipyrin, but so far as I have tried it, I consider it far superior to the latter, both in efficacy and safety. One objection exists regarding antifebrin. It is not soluble, and cannot therefore be easily given hypodermically. I used it in one case of sunstroke hypodermically, rubbing it up with glycerine and water, but I cannot give an opinion regarding its efficacy, as the patient died shortly after receiving the injection, the case having been a hopeless one from the first. Antipyrin, on the other hand, being soluble, can be conveniently used hypodermically, and when the patient is unable to swallow, or the stomach is very irritable, the drug can be easily administered by the skin, half the quantity as given by the mouth, grains 10, being a sufficient dose. Even admitting, therefore, antifebrin to be a better preparation in some respects, antipyrin has its uses in cases where medicines cannot be given by the mouth.

To sustain the vital powers by means of appropriate food and stimulants is, combined with good nursing and proper sanitary surroundings, the chief necessity in the treatment of this disease. This subject has been treated of before, but it may be repeated here that milk, diluted with lime-water and chlorate of potash solution, chicken broth, and (in the absence of diarrhœa) beef-tea, should be the diet of all cases of enteric fever, so long as the temperature is above normal. Much difference of opinion exists regarding stimulants and the period at which they should be given. My practise is, as soon as the pulse shows signs of the vital powers becoming depressed,—when it begins to be compressible and small in volume,—then is the time to begin. Some cases will of course require stimulants earlier than others; but it is well not to wait too long, and, in my experience, good brandy in small quantities, is advisable after the 10th or 14th day, and sometimes even earlier. It is well to commence with small quantities, say 2 ounces in twenty-four hours, giving a teaspoonful at a time in milk. *My custom is to meet the debility, and as* the disease progresses, stimulants should be given in an inverse ratio,—the lower the pulse, the larger and more frequent the amount. It is impossible to lay down any rules for the administration of stimulants. Some cases rapidly convalesce on small quantities, while others consume amounts almost incredible, without any apparent evil effect. I have frequently given 10, 12, and 14 and even 16 ounces of brandy in the twenty-four hours with good results; and if necessary, even more may be given with safety. As regards the class of stimulants, brandy is the most valuable of all, as it can be procured of good brands far more certainly than port or other wines. The present system of the supply of stimulants to hospitals in this country, introduced by Surgeon-General Madden, ensures our being supplied with good wines and spirits. This certainly was not the case a few years back, when the Commissariat made contracts, and our hospitals were, too frequently, the receptable of bazar rubbish of most uncertain origin.

Murchison warns us against the administration of carbonate of ammonia in large doses; but in cases of pneumonia occurring during enteric fever in small (3 grains) doses it is very useful.

To relieve distressing symptoms is, naturally, one of the first duties of a physician, and these must be treated on general principles.

Sleeplessness, which is often a most distressing symptom, particularly if it persists, may best be relieved by bromide of potassium and hydrate of chloral, and sometimes 5-grain doses of antipyrin act well.

In diarrhœa, when excessive, which it comparatively seldom is, in my experience, in India, 5-grain doses of chalk and opium powder, given in a little milk after each motion, generally suffices to keep it in check. If this fails, or there is a tendency to hæmorrhage, I have found ¼th of a grain of sulphate of copper with ¼th of a grain of opium, in pill, act efficiently. If these fail, other medicines may be tried. Sulphuric acid mixture, Dover's powder, Nitrate of silver, &c., but as previously stated, diarrhœa in this country is seldom, in my experience, severe or obstinate.

Hæmorrhage from the bowels frequently yields to the sulphate of copper and opium pill, but other astringents may be necessary, such as tannic acid, turpentine, &c. Ergot also answers well when other astringents fail. Probably the application of ice to the abdomen would be useful in severe cases, or cold water might be applied by means of Leitner's tubes.

Vomiting is seldom troublesome ; but when it occurs, it may be best relieved by sinapisms and hydrocyanic acid.

Tympanites is seldom, in my experience, a very troublesome symptom in India. There is, no doubt, in most cases a tumid state of abdomen and certain amount of gas in the intestines, but ordinary remedies generally hold these in check. When troublesome, I find turpentine in 10-drop doses, or a small dose of castor oil, with oil of peppermint minim ii, and Tt' of opium, minims v, in a couple of ounces of hot milk, gives great relief. Murchison states he finds the application of ice to the abdomen the best plan of treating great distension. It is conveniently applied by breaking ice up small and putting it in a large bladder. This should be placed on the abdomen with a fold of flannel between the ice bladder and the skin. Abdominal pain, when troublesome, should be relieved by fomentations, to which opium and turpentine might be added. A word here as to the best method of applying a fomentation. The flannel should be placed in a towel held over a basin by two persons. Boiling water should be poured on it from a kettle, and then the towel twisted opposite ways, so as to press out as much water as possible. A nearly dry fomentation cloth can be borne by the skin many degrees hotter than a wet one, and if over the hot cloth a folded towel be placed, the heat will be retained, and the bed kept dry. The turpentine and opium should be sprinkled on the flannel after it has been wrung out.

Complications must be treated, as they arise, on general principles. Pneumonia and bronchitis are not nearly so frequent, or so fatal as in Europe, yet most cases suffer from a certain amount of bronchial catarrh, and a large proportion from hypostatic congestion, to a greater or less extent. It is an excellent rule, and one I invariably insist on, to keep the patient as much on the side as possible during the whole course of the enteric attack, and so long as the strength permits of it, the decubitus should be in the lateral position. When the patient gets weak, and there is a tendency to lie on the back, the position most favouring hypostatic congestion, I keep him supported by means of a bolster-like roll of blankets, about 8 inches in diameter, rolled up tight and tied with tapes, or string, to keep it firm, and prevent it unrolling. The patient is then placed on his side, and the bolster put close up behind him. This prevents his rolling backwards. When too weak to remain long on his side, the attendants are instructed to assist him, and to keep him from turning on his back. The position should be changed about every two hours, from side to side, so as to prevent the gravitation of fluid to the base of either lung. When pneumonia sets in, turpentine stupes on spongiopiline, or jacket poultices of linseed meal, with small doses of carbonate of ammonia, combined with expectorants, is the simplest and most efficient treatment. In cold weather the ward should be kept up to a temperature of 60° at least, and this may be done either by stoves, or small charcoal fires allowed to burn quite clear before being brought into the wards, or by red-hot bricks, on which a little water may be sprinkled to keep the air warm and moist. On active service, in a cold climate, the absence of these precautions must largely increase the mortality from all forms of pulmonary disease.

Bed-sores should never be allowed to occur, and to prevent them, a careful daily examination of all prominent parts should be made. In this country, especially in the hot season, a wire-woven mattress is much superior in every way to an air or water-bed, being cooler and easily adaptable to the configuration of the body. If bed-sores do occur, they should be treated in the usual manner, especial care being taken to remove all pressure from the affected spots.

Thrombosis of the femoral vein occurred in two cases, and proved a troublesome complication, ultimately necessitating the invaliding home of the sufferers. The attack may best be treated by the local application of belladona, with a flannel roller, and the leg being well raised by means of a sling and cradle.

Peritonitis in this country is, in my experience, rare; but when it occurs, it must be treated actively on general principles. Probably the application of ice, as noted before, from the commencement of the attack, is the simplest and safest treatment. It should be combined with full doses of morphia given hypodermically.

One of the minor, but most troublesome, symptoms that occur during the course of the disease, is the condition of the lips and tongue. In some instances they are dry;

in others, cracked and fissured to such an extent as to prevent the patient protruding the tongue beyond the teeth; in some severe cases I have seen ulceration of lips, gums, and tongue of a most troublesome nature. So long as the patient is strong enough to wash out his mouth with lotions, a weak solution of Condy's fluid or borax answers well. Chlorate of potash is also very grateful, giving a sense of cleanliness to the mouth after its use. When the drying and cracking becomes severe, the local application of glycerine and borax, by means of a feather or brush, gives relief. When the tongue is deeply cracked or fissured, it is a good plan to touch the cracks to the bottom with a 20-grain solution of nitrate of silver, and afterwards apply borax and glycerine. In one case, in which a deep, ragged ulcer ate into the side of the tongue, threatening to open the lingual artery, the application of equal parts of acid hydro-chloric and glycerine stopped the extension of the disease, and brought on a healthy action. I have also found this a safe and excellent application in diphtheritic attacks. Cocaine solution might first be applied to the surface of the ulcer, and then the linctus be painted on with a brush.

Brain complications must be treated on general principles.

There are, of course, numerous other complications that may arise during the course of an attack of enteric fever, but these must be watched for, managed, and treated on ordinary principles, and need not be specially alluded to here.

Morbid anatomy.—I have not touched on the question of *post mortem* appearances as I have observed no difference between the viscera I have examined in India and at home. In every case I have found typical disease of the small intestines, with such changes in the other organs as were indicated by the symptoms during life. Indeed, a reference to *post mortem* examinations conducted twenty-five years ago (on cases diagnosed as remittent fever), made by careful observers, might, in many instances, have been substituted for those of cases of enteric fever of the present day. The signs were duly noted, but their significance and teaching were overlooked. Enteric fever in India, in my experience, differs in no way, in its morbid anatomy, from the same disease as seen in Europe.

CHAPTER XI.

GENERAL CONCLUSIONS.

(*a*). Enteric fever is a distinct disease in India, and though liable to modifications on account of the effects of climate, malaria, heat, &c., its general characteristics are practically the same as those of enteric fever as seen in Europe.

(*b*). Enteric fever is not a new disease, but has been present (unrecognised) since the advent of Europeans, and, possibly, among the native population, for ages.

(*c*). There is no such disease as "simple continued fever," and cases so called should either fall into the category of "enteric," or "malarial."

(*d*). The chief factors predisposing to attacks of enteric fever are—

I.—"youth;"

II.—"recent arrival;"

III.—"heat;" and

IV.—"over stimulating diet."

(*e*). Enteric fever can originate spontaneously, unlike scarlet fever, or small-pox, as illustrated by the history of the disease in the Suakim Expedition.

(*f*). Impure milk, ærated drinks, &c., procured in the bazars, or water procured from impure sources outside cantonments, are the chief causes of the disease among Europeans.

(*g*). The symptoms of enteric fever in India are almost identical with those observed in Europe, the chief exceptions being the absence of diarrhœa in the majority of the cases. Relapses are also more severe and frequent than in Europe.

(*h*). Pneumonia and bronchitis are rarer and less fatal than in Europe; while, on the other hand, head symptoms (especially in the hot weather) are more frequent and fatal.

(*i*). Ambulatory and mild cases are numerous, and should be carefully watched for.

(*j*). The prophylactic measures necessary are: "improvement in the sanitation of bazars;" "improvement in milk-supply;" "a less stimulating diet" in the hot season; "greater temperance;" "improved cooking;" and most important of all, the immediate removal to a sanitary hill station of "all new arrivals."

(*k*). Absorption wells are not only harmless but are the simplest, safest, and cheapest method of getting rid of the lavatory water.

(*l*). Enteric wards must be carefully organised and managed in every particular, and endless vigilance must be observed in all respects.

(*m*). All details of "nursing," "dieting," and "curative treatment," must be closely attended to, and till trained nurses are available, all men employed as orderlies should be carefully selected, taught, and supervised.

N.B.—Since the above was written, orders have been issued for the systematic training of soldiers as nurses, under the instruction of the Medical Officers, and as soon as the sister-nurses are available to superintend in nursing details, these orderlies will prove valuable assistants in military hospitals. Further steps are necessary. All trained men should wear a badge on left arm, as do signallers, marksmen, &c.; *they* should receive extra pay when employed in hospitals, and the Senior Medical Officer ought to be empowered to claim their services when necessary. Finally, they should never be liable to removal, while in charge of serious cases, without the consent of the Medical Officer in charge of the case.

LIBRARY.